Prevalence of Vaping and the Association with Cardiometabolic Risk in College Students

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Prevalence of Vaping and the Association with Cardiometabolic Risk in College Students

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Senior Honors Thesis

University of New Hampshire

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May 9th, 2022
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Abstract

Vaping is a growing public health concern; however, most reported prevalence rates have only focused on youth. The purpose of this study was to investigate prevalence rates among undergraduates (18–24 years old) and examine differences in cardiometabolic parameters between vapers and non-vapers. Students (n= 267) were recruited from an introductory nutrition course during Fall 2021 to participate in the College Health and Nutrition Assessment Survey. Prevalence data were collected through a self-reported wellness survey. More than half (55.1%) reported ever vaping. During the past 3 months, 7.9% reported zero use, 18.4% 1x/2x, 3.4% monthly, 10.5% weekly, and 15.0% daily/almost daily; 12.7% of students had a strong desire or urge to vape daily/almost daily. There were no differences in cardiometabolic assessments between males according to vaping status except for lower systolic blood pressure (SBP) between infrequent vapers vs. never/former vapers (115.4±8.5 vs. 123.6±14.1, p<.05). For females, BMI was higher in infrequent vs. never/former vapers (23.8±3.5 vs. 22.1±3.9, p<.05), waist circumference was larger in infrequent vs. regular and never/former vapers (82.3±9.9 vs. 78.1±11.3 and 76.9±7.0, respectively, p<.05), and SBP was lower in regular vapers vs. infrequent vapers and never/former vapers (107.1±9.4 vs. 112.3±8.6 and 111.1±10.1, respectively, p<.05). These results further our understanding of the vaping prevalence and cardiometabolic differences among college students.
Introduction

Vaping is defined as inhaling vapor through the mouth from an electronic device (e.g., electronic cigarette or e-cigarette) that produces an aerosol through heating up and vaporizing a liquid or solid that typically contains nicotine often in addition to other chemicals.\(^1\) Nicotine is a highly addictive substance and exposure can be harmful to brain development up through older adolescence. In addition, vaping usage is commonly associated with the dual use of traditional cigarettes and other tobacco products. Vaping devices are commonly referred to by other names such as vapes, vape pens, electronic delivery systems (ENDS), electronic cigarettes, E-cigs, E-cigarettes, mods, tank systems, and E-hookahs. Vapes vary in size as well as shape, however, most consist of the same core elements: a battery, a liquid holder, and a heating component.\(^1\)

The first reference to vaping devices was recorded in 1927 when Joseph Robinson filed for a patent.\(^2\) Throughout the decades there were various inventions of vaping devices, but it was not until 1998 that a United States tobacco company requested to bring a vaping device to the US market.\(^2\) However, the FDA declined the request since it was an unapproved drug delivery system. In 2003, Hon Lik developed the first successful commercial vaping device in Beijing, China. Later in 2006, e-cigarettes were introduced to the European market and the United States one year after. From 2008-to 2010, Turkey’s health administrators, the Thailand ministry of public health, and Singapore banned the sales of vaping devices altogether. In April 2011, the FDA announced that vaping devices would be regulated under the same conditions as traditional tobacco products.\(^2\) While the U.S. made improvements by regulating vapes, other countries were continuing to ban the sale of vaping products. In 2018, Israel banned the sale of Juul products, a popular e-cigarette company and the FDA launched an anti-vaping campaign to address the concerns of youth e-cigarette usage.\(^2\) Later that year, US Surgeon General, Jerome Adams issued
a public health advisory regarding vaping, and in 2019, the CDC continued to advise the public not to use e-cigarette products. In 2020, the White House announced that all flavored vaping products would be banned and the Senate passed the “Preventing Online Sales of E-Cigarettes to Children Act” (S.1253), which requires the age of the consumer to be checked when purchasing vapor products online. While the long-term effects of vaping are not well understood, ongoing research suggests that vapes are not safe to use. Further, contrary to popular belief, vapes are currently not approved by the FDA as an aid to help traditional cigarette smokers quit, and there is insufficient evidence of using vaping devices to help with smoking cessation.

Given the lack of knowledge regarding the effects of vaping on health, many studies created experiments to observe potential health differences in those who vape and those who do not. One study looked at the arterial blood pressure of healthy, non-smokers (22-24 years old) before and after exposure to e-cigarettes. It was found that vaporized nicotine acutely increased both systolic and diastolic blood pressures after participants were instructed to inhale a nicotine cartridge every 30 seconds for ten minutes. A 2014-2016 cross-sectional study done through the National Health Interview Survey compared and calculated the odds of myocardial infarction about daily vaping use in participants 18 years and older. The study found that daily vaping device usage can increase the chances of myocardial infarction with and without other risk factors. In addition, a double-blind study that consisted of seventeen healthy occasional tobacco product users found that vaping can cause an acute increase in arterial stiffness, which is a risk factor that leads to strokes and myocardial infarctions. The authors report a significant increase in both systolic blood pressure and diastolic blood pressure as well as flow resistance in the respiratory system following vaping usage. The flow resistance indicated that vaping could cause airway obstruction properties. While these studies suggest that there are acute differences in
cardiometabolic and respiratory functions, it is difficult to determine the long-term health effects vaping will have on the human body.

The European Society of Cardiology suggests that e-cigarettes may have a lower risk than traditional cigarettes for developing emphysema or cancer.\textsuperscript{6} However, the use of vaping devices may lead to worse cardiovascular outcomes than traditional cigarette use based on data collected thus far.\textsuperscript{6} In 2020, a critical review of 264 PubMed peer-reviewed articles relating to vaping usage and its relationship to metabolic syndrome was conducted.\textsuperscript{7} Metabolic syndrome is defined as having at least three out of the five risk factors present: elevated arterial pressure (≥130/85 mmHg), abnormal waist circumference (depended on population group), hyperglycemia (≥100mg/dL), low HDL cholesterol (<40 mg/dL in men and <50mg/dL in women), and elevated triglyceride concentration (≥150mg/dL). The review found the risk of developing metabolic syndrome was associated with traditional cigarette smokers and dual users, those who engage in traditional cigarette usage as well as vaping, but it was not determined that independent vaping usage alone is a risk for developing metabolic syndrome since most studies consisted of participants who have used traditional cigarettes with or prior to vaping.\textsuperscript{7} Another cross-sectional study used data from 2013-2015 with participants ≥19 years old and found that e-cigarette users showed a higher odds ratio for abdominal obesity as well as hypertriglyceridemia than participants who never used e-cigarettes, which indicated that there may be some risk association between e-cigarette usage and metabolic syndrome.\textsuperscript{8}

Along with some suggested health risks of vaping, prevalence throughout the United States and the state of New Hampshire is on the rise, while rates of traditional smoking are decreasing. The National Youth Tobacco Survey reported that vaping doubled from 3.3\% in 2011 to 6.8\% in 2012, with vaping rates now 10x higher than in 2011.\textsuperscript{9} The prevalence rates of
electronic cigarette usage amongst adolescents have been consistently rising over the years and health organizations, as well as government officials, have spoken out against vaping usage.\textsuperscript{1,2,10} The increase in vaping usage has occurred as prevalence rates of cigarette usage have plummeted. Many studies focus on the prevalence rates and effects of e-cigarette usage on younger adolescents and leave out college students (18–24 year-olds) and there are even fewer that focus on the health differences between those who do and do not vape.

In July of 2016, the New Hampshire Division of Public Health Services put out a public health advisory to providers about the potentially harmful effects of vaping, which is still ongoing.\textsuperscript{10} In 2019, the Youth Risk Behavior Survey (YRBS) reported the national prevalence rate for adolescents who vaped at least one out of 30 days as 32.7\%. Also, the YRBS reported a prevalence rate of 33.8\% for adolescents who currently vaped at least one out of 30 days in the state of New Hampshire. Adding to that the YRBS reported frequent vaping usage (20 or more days) as 10.7\% at the national level and 13.5\% in New Hampshire.\textsuperscript{11} The New Hampshire Education Alcohol, Nicotine, and Other Drugs Report has shown that prevalence of vaping in undergraduate students at the University of New Hampshire, Durham has increased over the past four years.\textsuperscript{13} The study consisted of a random sample of 4,500 to whom 866 students responded. In 2017, 2019, and 2021 it was found that 14.2\%, 30.8\%, and 29.1\% of students indirectly reported the use of vapes within the last 30 days, respectively. The study also showed a decrease in smoking tobacco; in 2017, 2019, and 2021 it was found that 75.2\%, 85.4\%, and 84.7\% of students did not report the use of smoking tobacco in the last 30 days, respectively (N. Bushinsky, personal communication, September 15, 2021).\textsuperscript{13} In Spring 2019, the American College Health Association (ACHA) conducted a study on risk behaviors and health at the University of New Hampshire (UNH) and found that 22.8\% of undergraduate students reported
vaping usage within the past 30 days; 11.4% used 1-9 days, 3.6% used 10-29 days, and 7.7% used all 30 days. Also, 9.7% of undergraduate students reported cigarette usage within the past 30 days; 7.2% used 1-9 days, 0.9% used 10-29 days, and 1.6% used all 30 days (N. Bushinsky, personal communication, September 15, 2021). The difference in the prevalence of vaping usage and cigarette usage could be explained by students thinking vaping is not harmful or as harmful smoking traditional cigarettes.

The purpose of this study is to investigate vaping prevalence rates among undergraduates (18–24 years old) and examine differences in cardiometabolic parameters between vapers and non-vapers. In addition to looking at vaping prevalence, the specific health parameters examined in this study were BMI, waist circumference, systolic blood pressure (SBP), diastolic blood pressure (DBP), total cholesterol, HDL, LDL, triglycerides, and glucose. It is hypothesized that health parameters would differ between students who vaped to those who do not with vapers having higher waist circumference, SBP, DBP, total cholesterol, LDL, triglycerides, glucose and a lower BMI and HDL than non-vapers.

**Methods**

Data were collected as part of the Fall 2021 College Health and Nutrition Assessment Survey (CHANAS), an ongoing, cross-sectional study that collects and interprets diet, health, and lifestyle-related data to help improve the health of young adults at the University of New Hampshire. The CHANAS project was started in 2005 and has been directed by Dr. Jesse Stabile Morrell with the help of faculty, as well as trained research technicians at the undergraduate and graduate levels. The CHANAS project participant pool consists of University of New Hampshire undergraduate students ages 18-24 years old recruited from the
The height assessment procedures began with participants being instructed to remove their shoes and hair accessories. Next, the technician would check for four points (head, shoulders, buttocks, and heels) of body contact with the Heighttronic Stadiometer Model 235. Students were instructed to look straight ahead with the Frankfurt plane level on the floor as well as to take a deep breath and stand tall. Then the technician would move the stadiometer top slide and fix it in place, making sure that it was firmly against the participant’s head. The height was then recorded in centimeters at least twice and repeated until measures were within 0.2 centimeters.

The weight assessment procedures began with the technician taring the scale (Tanita BWB-800S). Students were instructed to remove excess clothing and to empty their pockets. The technician made sure the students were standing with their feet centered on the scale. The weight was then recorded to the nearest 0.1 kilograms at least twice and repeated until measures were within 0.2 kilograms.

The body composition assessment procedure began with students cleaning the bottom of both feet with an alcohol wipe. While the participants were cleaning their feet the technician
entered the following data on the bioelectrical impedance scale (Tanita TBF-300A): sex (male standard or female standard), age (in years), and height (in centimeters, rounded to the whole number). The student was then instructed to step on the scale, centering each foot over round depressions of the footplate. Measurements were collected twice and printed by the device.

Abdominal obesity was assessed by measuring the student’s waist circumference at both the minimal circumference and at the iliac crest. The minimal waist circumference was measured using the Gulick Tape Measure, which was placed horizontally around the body, level to the floor, and against the skin. The tape was then gently tightened around the participant’s minimal waist until the marker was just exposed on the tape. The students were instructed to take a deep breath and exhale. The value was measured at the end of the expiration and recorded at least twice to the nearest tenth of a centimeter and repeated until measurements were within 0.5 cm. This same process was repeated with the waist circumference measurement taking place at the top of the iliac crest, which was marked with a marker before measurement.

The cholesterol and blood glucose levels were determined using a finger-stick collection method and a Cholestech LDX machine to analyze the levels. Participants were instructed to fast eight hours before blood collection. Before the finger stick was performed the student's middle finger on the non-dominant hand was cleaned with an alcohol wipe and then dried thoroughly with a textured gauze. Then students were instructed to sit with feet flat on the floor and relax their non-dominant arm on their lap. Next, the finger was firmly pricked with a lancet and the first drop of blood was wiped away. The finger was then squeezed until there was a large drop of blood, which was collected via a capillary tube, the tube was kept positioned horizontally to the ground during the collection period. For slower “bleeds” the participant was instructed to relax their hand, and the finger was re-wiped with gauze if needed. After the capillary tube was filled
to the black line it was dispensed into a cassette and inserted into the Cholestech analyzer. While the test was running, a band-aid was applied to the student’s pricked finger and they were instructed to sit quietly back in the chair, with their feet on the floor. After the test was run total cholesterol (TC), high-density lipoprotein (HDL), low-density lipoprotein (LDL), triglycerides (TRG), and glucose (GLU) levels were printed out from the machine.

The blood pressure procedure began with the student resting for five minutes and quietly seated with their feet flat on the floor. The student’s right arm was sized and measured in centimeters at the midpoint between their shoulder and elbow. An arm circumference chart determined the appropriate cuff size for the technician to use on the student. The cuff was then connected to the air supply tube and the participants were instructed to rest their right hand on the table with their palm facing up. The cuff artery position mark was then aligned with the participant’s brachial artery and wrapped snugly using both hands, secured with the lower edge of the cuff placed ½” to 1” above the inner side of the elbow joint. The blood pressure was then taken using an automatic blood pressure machine that calculated the blood pressure twice with one minute of rest between each measure. The systolic and diastolic blood pressure as well as resting pulse rate results are then recorded for each measurement as well as the average.

Another research component of CHANAS is an online survey (Qualtrics) completed by each student during the 2nd or 3rd week of the semester. This survey contains questions regarding risk behaviors and lifestyle choices. Vaping questions were added to this pre-existing survey and modeled after national risks behavior surveys such as YRBS, BRFSS, and ACHA. The following questions were asked: Have you ever used an electronic vaping product (including e-cigarettes, vapes, vape pens, e-cigars, e-hookahs, hookah pens, and mods)? During the past 3 months, how often have you had a strong desire or urge to use an electronic vapor product (including e-
cigarettes, vapes, vape pens, e-cigars, e-hookahs, hookah pens, and mods)?, and during the past 3 months, how often have you used an electronic vapor product (including e-cigarettes, vapes, vape pens, e-cigars, e-hookahs, hookah pens, and mods)? In addition, the following pre-existing questions regarding smoking were analyzed: Have you ever smoked at least 100 cigarettes in your entire life? (NOTE: 5 packs = 100 cigarettes)? and Do you NOW smoke cigarettes every day, some days, or not at all?

At the beginning of the data collection process, each participant was assigned a CHANAS ID for privacy. All data collection forms were redacted and replaced with the CHANAS ID. All health parameter measurements and survey questions were recorded either directly through a Qualtrics survey or on paper by a research technician then into a Qualtrics web form.

Data were separated into male and female groups, ages 18-24 years old (n=267). The data was further separated into three vaping status categories based on the self-reported vaping responses. Never or former vapers were defined as students who never vaped or have not vaped within the past 3 months. Infrequent vapers were defined as students who vaped once or twice, or monthly within the past 3 months. Regular vapers were defined as students who vaped weekly, almost daily, or daily within the past 3 months. Data are presented as means±standard deviations or percentages and stratified by males and females. ANOVA was used to explore mean differences between vaping and non-vaping groups; p<.05 (SPSS v 27).

Results

In the Fall of 2021, 310 students enrolled in the introduction to nutrition course, and 281 consented to the study (UNH IRB #5524). Almost half the sample (n=267, 47.2%) reported
vaping within the past three months (Figure 1). Also, during the past 3 months, 52.8% of students reported zero use, 18.4% used once or twice, 3.4% used monthly, 10.5% used weekly, and 15.0% used daily or almost daily. Male students overall reported greater vaping prevalence with 51.0% vaping within the past three months and 45.1% of female students vaping within the past three months (Figure 1). In addition, more frequent vaping usage was found among males than females with 19.1% vaping almost daily or daily (Figure 1). One-third of students (33.3%) reported feeling a strong desire or urge to vape at least once over the past three months with 12.7% of students having that desire almost daily or daily (Figure 2). Overall, female students (19.5%) reported a stronger desire or urge to vape at least once than male students (13.9%). Also, cigarette prevalence (4.1%) was found to be much lower than vaping prevalence (47.2%).

There were no statistical differences in BMI, waist circumference, systolic blood pressure, diastolic blood pressure, total cholesterol, HDL, LDL, triglycerides, and glucose found among male vaping groups (Table 1). Among the male vaping groups, never or former vapers and regular vapers had similar cardiometabolic measures in BMI, waist circumference, and diastolic blood pressure (23.5±3.3 vs. 23.5±4.6, 82.2±8.4 vs. 82.2±10.5, 69.7±9.2 vs. 69.3±7.4, \( p > .05 \)). The mean systolic blood pressures for male vaping groups were lower in infrequent vapers than in never or former vapers and regular vapers (115.4±8.5 vs. 123.6±14.1 and 121.3±9.0, \( p > .05 \)). For female vaping groups, never or former vapers had lower BMI than infrequent vapers (22.1±2.9, 23.8±3, \( p < .05 \)). There were no differences found in BMI between regular female vapers and infrequent female vapers, or regular female vapers and never or former female vapers (Table 1). Never or former female vapers and regular female vapers had a lower waist circumference than infrequent female vapers, respectively (76.9±7.0, 78.1±11.3, 82.3±9.9, \( p < .05 \)). The mean systolic blood pressure for female vaping groups was lower in
regular vapers than in never or former vapers and infrequent vapers (107.1±9.4 vs. 111.1±10.1 and 112.3±8.6, p>.05). For female vaping groups, there were higher means of total cholesterol, HDL, LDL, and triglycerides levels than their respective male vaping groups (Table 1). Male vaping groups had higher means of BMI, waist circumference, systolic blood pressure, and glucose than their respective female vaping groups (Table 1).
Figure 1. Fall 2021 vaping usage among UNH students.
Figure 2. UNH students (n=267) desire to use an electronic vaping device.
Table 1. Vaping Frequency and Health Measures of UNH Students

<table>
<thead>
<tr>
<th></th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Never/Former Vapers (n=29-43)</td>
<td>Infrequent Vapers (n=13-15)</td>
</tr>
<tr>
<td><strong>BMI (kg/m²±SD)</strong></td>
<td>23.5±3.3</td>
<td>24.1±4.0</td>
</tr>
<tr>
<td><strong>Waist Circumference (cm±SD)</strong></td>
<td>82.2±8.4</td>
<td>84.5±9.6</td>
</tr>
<tr>
<td><strong>Systolic BP (mmHg±SD)</strong></td>
<td>123.6±14.1</td>
<td>115.4±8.5</td>
</tr>
<tr>
<td><strong>Diastolic BP (mmHg±SD)</strong></td>
<td>69.7±9.2</td>
<td>70.7±9.7</td>
</tr>
<tr>
<td><strong>Total Cholesterol (mg/dL±SD)</strong></td>
<td>141.5±26.4</td>
<td>141.1±17.4</td>
</tr>
<tr>
<td><strong>HDL (mg/dL±SD)</strong></td>
<td>43.2±12.2</td>
<td>44.5±11.5</td>
</tr>
<tr>
<td><strong>LDL (mg/dL±SD)</strong></td>
<td>84.3±17.0</td>
<td>81.5±24.6</td>
</tr>
<tr>
<td><strong>Triglycerides (mg/dL±SD)</strong></td>
<td>85.2±26.7</td>
<td>79.8±27.4</td>
</tr>
<tr>
<td><strong>Glucose (mg/dL±SD)</strong></td>
<td>90.0±8.8</td>
<td>91.5±5.8</td>
</tr>
</tbody>
</table>
Discussion:

Our findings for vaping prevalence rates (28.9%-47.2% within the past 30 days) are consistent with previous UNH studies (N. Bushinsky, personal communication, September 15, 2021). It is important to note that the vaping prevalence reported was regarding 3 months and not over the course of 30 days, which is the timeframe reported in the New Hampshire Education Alcohol, Nicotine, and Other Drugs Report and could lead to variation. However, when considering response bias the data suggests there may have been a higher vaping prevalence that has gone underreported in previous years. Further, the New Hampshire Education Alcohol, Nicotine, and Other Drugs Report had an overall response rate for the previous year of 19.2% whereas the response rate in this study was 86.1%, after removing students outside the ages of 18-24 years old. The difference in response rate could be due to how students were recruited. Specifically, for the New Hampshire Education Alcohol, Nicotine and other Drugs Report students were sent the survey questions randomly via email whereas in this study students were already performing these health assessments for class assignments and just had to fill out a consent form to use their results in the study.

When comparing vaping prevalence data to the ACHA Spring 2019 data, our current data suggest a higher vaping prevalence overall. The ACHA reported that 22.8% of UNH students vaping within the past 30 days. Also, 15.0% of students reported vaping almost daily or daily within the past 3 months while the ACHA reported only 11.3% of students 10-30 days over the course of 30 days. The higher vaping prevalence found in men over women is consistent with what was prevalence reported in the ACHA with 30% of men vaping within the last 30 days and 19.9% of women. For the question in the survey that asks about having a strong desire or urge to vape, the prevalence results reported were lower than what was found in the Fall 2020 ACHA
survey, which reported that 32.0% of participants had a strong desire or urge to use tobacco or nicotine delivery products daily or almost daily.\textsuperscript{16} However, the difference in results when compared could be explained by the ACHA not isolating the use of vaping products from other tobacco products as well as having a larger, more diverse sample of college students than available for this study.

In comparison to youth frequent vaping prevalence in New Hampshire, the prevalence among UNH college students who vaped frequently appeared to be slightly higher (13.5% vs. 15.0%).\textsuperscript{11} As youth vaping rates tend to naturally increase alongside grade levels in school, this data would be consistent with college following the next grade level in this case.\textsuperscript{17} When comparing youth vaping prevalence rates and UNH traditional age college students in New Hampshire who have ever vaped within the past 30 days, there was a higher prevalence amongst college students (33.8% vs. 47.2%).\textsuperscript{11} This difference could be explained by the fact that college students have more access to vaping devices due to their age, environment, and previous limited vaping restrictions at the university.

As previously stated, there were no differences seen among college men vaping groups and only moderate cardiometabolic differences seen among college-aged women; never or former vapers had lower BMI and lower waist circumference than infrequent vapers (22.1±2.9 vs. 23.8±3 and 76.9±7.0 vs. 82.3±9.9, $p<.5$). There were no differences seen in BMI and waist circumference between regular vapers and never or former vapers, which indicated that there may be other factors besides vaping usage that played a role. Overall, the lack of observed differences in cardiometabolic assessments could be explained by students not vaping long enough or as frequently to have cardiometabolic differences when compared to non-vapers. It is difficult to determine exactly how long the students were vaping since vaping usage was only
reported over the course of three months. In addition, most of the previous research conducted about cardiometabolic data was either collected directly after a participant vaped or the participant was using both e-cigarettes and traditional cigarettes. One study suggested that vaping usage increased the risk of myocardial infarction due to its association with inflammation, platelet activation, oxidative stress, activation of the sympathetic nervous system, and endothelial dysfunction.\(^4\) However, it was difficult to determine in the study if those who used vapes to help with smoking cessation suffered a myocardial infarction because of their previous use of traditional cigarettes or their current use of vapes.\(^4\) Another study found that healthy non-smokers (22–24 years old) experienced an arterial blood pressure increase after acutely vaping.\(^3\) The participant’s blood pressure returned to baseline during the recovery period.\(^3\) However, this study did not perform cardiometabolic measurements on those who have vaped consistently over longer periods of time. In our current study students were not instructed to vape before any health parameter measurements were completed nor were they asked if they vaped before those measurements. Also, the cardiometabolic assessments and health parameters were chosen to be measured were based on the factors contributing to metabolic syndrome. For young adults (20-39 years old), the prevalence of metabolic syndrome in the U.S. is 19.5% with increasing rates in Asian and Hispanic populations.\(^18\) In general, metabolic syndrome prevalence in this age group is relatively low, which is another reason why there may have only been moderate differences observed. In 2011, the CHANAS study reported only 6% and 12% of college women and men (18-24 years old) met the clinical criteria for metabolic syndrome.\(^19\)

There are important limitations to note regarding our study. The data was self-reported, so the prevalence of vaping may be higher if students were not reporting honestly. In addition, this sample of students is enrolled in a nutrition class and may have been a healthier pool of
students vs. the larger college campus population since they have enrolled in a course about human nutrition and health. However, it could also be argued that this pool of students was not specifically recruited for vaping-related health assessments, which could also be more representative of the UNH population. The results of this study should be used with caution when generalized to other college campus communities since UNH’s racial and ethnic diversity is not representative of the United States. Future studies that include a more diverse and larger sample of college students may be more representative to the broader population of U.S. undergraduates. In addition, future studies that looked at subpopulations may also help figure out how to decrease vaping prevalence in this age group. As stated previously, covariates such as alcohol use were not accounted for, and future studies utilizing alcohol as a covariate would help more accurately determine the effects of vaping on our health.

In February of 2022, UNH announced that the university will be Tobacco, Smoke, and Nicotine (TSN) Free, which prohibits the use of vaping devices. This policy change was created to help reduce the number of students who smoke and are exposed to second-hand smoke on campus. Further research on prevalence rates within the coming years will determine if this policy change deterred vaping usage. UNH vaping prevalence data has only been reported through the ACHA and the New Hampshire Education Alcohol, Nicotine, and Other Drugs Report. This study provides UNH with additional data on the number of students who vape prior to the launch of the TNS Free Policy. This data can be used as a baseline to help determine if that policy over time helped deter students from vaping. Other universities have adopted similar policies in recent years. Between 2012 and 2017 the number of campuses that have banned e-cigarette use has doubled. As of November 2017, 1,658 U.S. colleges and university campuses banned the use of e-cigarettes. However, it is unclear if these policies have made
large differences in vaping prevalence among students, but it is a step in the right direction to change the culture around vaping. This study showed that a high percentage (47.2%) of students have recently vaped in the Fall 2021 semester and suggests that more education at UNH needs to be done on the potential risks that vaping poses to health. This data can help bring attention to vaping as a public health issue on UNH campus and push administrators and health educators to further develop early intervention and education programs to help target behavior change and decrease overall vaping rates among UNH students.

**Conclusion:**

Vaping prevalence among young adults attending college appears to be higher than it has been reported in previous years. With 47.2% of students reporting recent vaping, our data shows that UNH students have a higher vaping prevalence than younger adolescents in New Hampshire (Figure 1). This suggests the need for further research on the prevalence, education, and interventions. Our study did not observe major health differences between vapers and non-vapers; however, this may be explained by the age, health, and lack of specific vaping frequency reported. Other research has indicated that vaping poses health risks, but the long-term effects remain unknown. Further research on health differences among students who vape will expand our understanding on the health outcomes and aid in promoting healthful behavior change.
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