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## Discrepancies in the Estimation of Vaping Rates Among College Students

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DISCREPANCIES IN THE ESTIMATION OF VAPING RATES AMONG COLLEGE  
STUDENTS

DISCREPANCIES IN THE ESTIMATION OF VAPING RATES AMONG COLLEGE  
STUDENTS

by  
Cameron Klug

A Thesis Submitted in Partial Fulfillment  
of the Requirements for the  
University Honors Program

---

Department of Anthropology and Sociology

The University of South Dakota

May 2023

DISCREPANCIES IN THE ESTIMATION OF VAPING RATES AMONG COLLEGE  
STUDENTS

The members of the Honors Thesis Committee appointed  
to examine the thesis of Cameron Klug  
find it satisfactory and recommend that it be accepted.

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DISCREPANCIES IN THE ESTIMATION OF VAPING RATES AMONG COLLEGE  
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**ABSTRACT**

Discrepancies in the Estimation of Vaping Rates Among College Students

Cameron Klug

Director: Louisa Roberts, Ph.D.

The use of nicotine inhalation products among college students is an imminent public health issue, with young-adult populations being particularly likely to take up nicotine use during their college years (American College Health Association, 2021). Even with elevated levels of nicotine vapor product use in college populations, existing surveys may still underestimate the prevalence of nicotine use among this population. This study aimed to address this issue by conducting a survey of college students at the University of South Dakota, using a peer-to-peer approach to reduce social desirability bias. The study's survey directly stated it was being issued and analyzed by a college student. The study also included an observational analysis to lend further credence to the survey results. The survey found significantly higher rates of vaping compared to official statistics from the National College Health Assessment and other agencies. These findings highlight the need for more accurate data-collection methods and interventions to reduce nicotine use among college students.

**KEYWORDS:** vaping, e-cigarettes, nicotine, social desirability bias, South Dakota

DISCREPANCIES IN THE ESTIMATION OF VAPING RATES AMONG COLLEGE  
STUDENTS

**TABLE OF CONTENTS**

List of Figures	v
Acknowledgments	vi
Introduction	1
Research Methodology	11
Results	15
Discussion and Conclusion	22
Appendix	25
References	30

DISCREPANCIES IN THE ESTIMATION OF VAPING RATES AMONG COLLEGE  
STUDENTS

**LIST OF FIGURES**

Figure 1: Respondent Age

Figure 2: Gender Identity

Figure 3: Nicotine Vapor Product Use

Figure 4: Individuals Who Vaped in the Last 3 Months at The University of South Dakota

Figure 5: Individuals Who Vaped in the Last 3 Months in the NCHA

DISCREPANCIES IN THE ESTIMATION OF VAPING RATES AMONG COLLEGE  
STUDENTS

**ACKNOWLEDGMENTS**

I am thrilled to have had the opportunity to conduct vaping research at the University of South Dakota. This research combined various topics from an array of my undergraduate coursework and became the highlight of my undergraduate career. I owe much of my success in this thesis and my overall undergraduate career to others.

First, I would like to express my gratitude to my thesis director, Dr. Louisa Roberts. Her unwavering support and guidance throughout the research process continued to move this thesis forward. Her expertise in many fields, prevailing wisdom, and sincere encouragement were invaluable in shaping this thesis and making it what sits below. I will forever be appreciative of our many conversations and a-ha moments.

I am also profoundly grateful to my committee members, Dr. Barbara Goodman and Dr. Samuel Herley, for their invaluable insights, constructive feedback, and unwavering support. Their comments and suggestions in the formative stage of this thesis were instrumental in helping me navigate the research process.

I would also like to thank Dr. Angela Landeen for her assistance in laying out the initial portions of this study and for connecting me with Dr. Louisa Roberts; this thesis would still be an idea without her. I would like to thank the Institutional Review Board for their advice while outlining this thesis. I would also like to thank the University of South Dakota students for participating in this study. Their willingness to share their habits was essential to the success of this project.

DISCREPANCIES IN THE ESTIMATION OF VAPING RATES AMONG COLLEGE  
STUDENTS

Finally, I would like to express my gratitude to my family and friends for their love, support, and patience throughout this journey. Their unwavering encouragement and understanding were essential in helping me stay focused and motivated to complete this thesis.



# DISCREPANCIES IN THE ESTIMATION OF VAPING RATES AMONG COLLEGE STUDENTS

## CHAPTER ONE

### Introduction

Vapes, nicotine vapor products, e-cigarettes: no matter the terminology, the popularity of these products is a pressing issue in society today, given the probable health risks. Studies indicate that vaping is on the rise among college students and other populations nationally. This is known. Indeed, vaping is known to have been popular among American college students for nearly a decade (American College Health Association, 2022; King, Patel, Nguyen, & Dube, 2015). However, there is some reason to suspect that the current estimates of vaping usage rates among college students may be too low for various reasons. This study will investigate this possibility.

With its popularity skyrocketing in recent years, vaping has emerged as new trendy addiction among the nation's college population (Barrington-Trimis et al., 2016). Moreover, e-cigarette use has become a normative behavior, termed acceptable by many (Kong et al., 2019). In this chapter, I will provide a historical account of the emergence of vaping and the factors that have contributed to its widespread use in college populations. I will also address the potential health risks associated with vaping and how they differ from traditional cigarette smoking. The following section will delve into the various survey methods used to estimate vaping rates among college students. I will also uncover why there may be a reason to believe these data collection methods underestimate actual usage rates. Finally, at the end of this chapter, I will provide an overview of what will be covered in each subsequent chapter.

Smoking is a pressing issue in modern society. Millions of college students in America struggle with nicotine addiction in its many forms (American College Health Association, 2021).

## DISCREPANCIES IN THE ESTIMATION OF VAPING RATES AMONG COLLEGE STUDENTS

Despite copious efforts to curb smoking and vaping rates, smoking and vaping both remain major public health concerns. In college populations, vaping is a particular concern, with a significant number of students taking up nicotine use during their college years for various reasons (American College Health Association, 2021).

Nicotine, a stimulant drug found in the tobacco plant- *nicotiana tabacum*- is globally one of the most widely used addictive substances (Hurt et al., 1996). It is estimated that around one billion people are smokers globally (World Health Organization, 2021). This massive number has been growing since the dawn of recorded history; the first recorded use of tobacco dates to the ninth century, when it was used in religious ceremonies by the Mayan people (Hurt et al., 1996). As humans moved around the globe, so did tobacco.

Over time, the use of tobacco greatly increased. Nevertheless, even with immense use, tobacco was recognized as harmful many years ago. In 1604, King James I of England published a statement calling tobacco a “loathsome and stinking weed” (James, 1604, p. 1). Even with these warnings, the popularity of tobacco continued to escalate. Upon the mass production of cigarettes, use quickly increased.

The harmful effects of tobacco use on health began to be recognized in the late twentieth century. As more and more people began to experience chronic lung conditions, preliminary studies began. In 1964, the United States Surgeon General released a report on the health effects of various inhalation products. The study was the first to link tobacco inhalation to lung cancer and various other diseases (U.S. Department of Health and Human Services, 2014). This report was groundbreaking. At the time, physicians even endorsed tobacco. Following this report,

# DISCREPANCIES IN THE ESTIMATION OF VAPING RATES AMONG COLLEGE STUDENTS

numerous studies have linked tobacco use to a range of health problems, including chronic killers: cancer, heart disease, and stroke (U.S. Department of Health and Human Services, 2014).

Nicotine use has always been an issue among the American population. However, due to education campaigns, use readily decreased throughout the late 1900s (Burns & Lee, 1996). Nevertheless, the introduction of electronic vapes opened the door of addiction to a new population: college students.

Vaping, or the use of electronic nicotine vapor delivery systems, was patented in 2003 as a safer alternative for cigarette smokers. Hon Lik, a Chinese pharmacologist, invented vapor technology to curb his tobacco addiction. With his father recently passing away from lung cancer, Lik was determined to find a safer cigarette alternative. So, using his background in pharmacology, he created the first e-cigarette. This new form of nicotine delivery consisted of a base, mainly propylene glycol, various flavorings, and manufactured nicotine salts (Better Health Channel, 2020). After making it to market, his product, now commonly called a vape, saw rapid growth under names like JUUL, Vuse, Cali Bar, and many others. Intended to benefit tobacco smokers-and in some circumstances helping them-Lik's product would divert from its intended use: beginning to create a new pathway to nicotine addiction for young adults (Vaping Post, n.d.).

Recent studies have also indicated that vaping may not be as safe as Chinese pharmacologist Lik, previously assumed. While some have argued that vaping may be a less harmful alternative to traditional smoking, no longitudinal studies have been performed. Short-term studies have found various issues with this nicotine aerosol delivery system (American Lung Association, 2022).

## DISCREPANCIES IN THE ESTIMATION OF VAPING RATES AMONG COLLEGE STUDENTS

One of the worst-known effects of vaping is its impact on lung health. The American Lung Association found that e-cigarette use can cause an array of issues, including lung irritation and inflammation. E-cigarettes can lead to a host of respiratory problems, including chronic bronchitis, asthma, and pneumonia (American Lung Association, 2022). These conditions are just the beginning. Vaping can also lead to the development of the recently trending condition known as “popcorn lung.” This condition, attributed to various factors including poor ingredient additives, causes scarring and narrowing of the airways, making it difficult to breathe (American Lung Association, 2016). In addition to its effects on lung health, cardiovascular issues have also been linked to vaping. A 2018 study published in the Journal of the American Heart Association found that e-cigarette use can increase oxidative stress levels. This stress can cause damage to blood vessels and increase the risk of heart disease (Middlekauff et al., 2017). Middlekauff also found that e-cigarette use can increase the risk of heart attack and stroke.

The effects of vaping can be extremely similar to the effects of cigarettes. Like cigarettes and other tobacco products, vaping can also have a negative impact on a person’s well-being. Nicotine releases dopamine and various other neurochemicals that can have a significant impact on the brain’s reward system. This flood of neurochemicals can lead to addiction and withdrawal (American Lung Association, 2022). With withdrawal comes irritability, syncope, nausea, and mental health issues. Additionally, the chemicals and toxins found in e-cigarette vapor can damage the mouth, throat, and digestive system. While vaping was initially marketed as a safer alternative to cigarette smoking, the known harmful effects of vaping are becoming increasingly apparent. Lik’s intentions may have been for the best, but vaping’s impact on lung health and cardiovascular health is for the worst.

## DISCREPANCIES IN THE ESTIMATION OF VAPING RATES AMONG COLLEGE STUDENTS

Recently, vaping has become a popular “trend” among college students. College students have reported various reasons for the use of vapor devices. According to a study by Kong et al. (2015), the most common reason reported by college students for vaping was to reduce stress and anxiety. College students often use nicotine as a coping mechanism or a way to deal with the stress of college. Other reasons included socializing, enjoyment, and replacing traditional cigarette smoking- although not as common. Some students also reported using e-cigarettes as a weight loss aid (Kong et al., 2015). Nevertheless, vaping has not been proven to be an effective weight loss aid.

According to various studies, one of the main reasons why college students prefer vaping over cigarettes is the perception that vaping is a healthier alternative (National Institute on Drug Abuse, 2020). Originally marketed as a safer alternative, college populations believe picking up a vapor device is better than a cigarette. Nevertheless, this belief is debatable, as vapor products can cause various issues like cigarettes.

College students believe e-cigarettes are less harmful to their health than other forms of nicotine distribution. According to a survey by the National Institute on Drug Abuse, 66% of college students believed e-cigarettes were less harmful than cigarettes (National Institute on Drug Abuse, 2020). Vaping has been touted by many to be the less-unhealthy form of nicotine use. Nevertheless, more research must be done to confirm this statement.

According to college students, vaping also offers a more customizable and social experience than smoking. E-cigarettes come in various flavors and can be tailored to individual preferences. Flavors like strawberry peach, cool mint, or tropical explosion, coupled with the ability to use e-cigarettes in a variety of social settings, make vaping more appealing to college

## DISCREPANCIES IN THE ESTIMATION OF VAPING RATES AMONG COLLEGE STUDENTS

students than smoking cigarettes. These flavors also seem harmless compared to the taste of combusting tobacco. According to the Truth Initiative, a nonprofit tobacco control organization, many young adult e-cigarette users enjoy trying new flavors of vapor devices. Also, over 97% of youth who vape use flavored products (Truth Initiative, 2021). With names similar to dessert flavors, the many vapor product flavors are concerning (Barrington-Trimis et al., 2014).

Another reason why college students prefer vaping over cigarette smoking is that vapor devices are less stigmatized than traditional cigarettes. Cigarette smoking has been associated with negative stereotypes, such as being dirty, smelly, or unattractive. In contrast, vaping is often seen as more modern and trendy. This perception is reinforced by the marketing of e-cigarettes, which often uses sleek designs and appealing imagery to draw in younger audiences (Barrington-Trimis et al., 2016). This is easily visible in vaping advertisements. At the University of South Dakota, my experience has been that vaping is seen as more convenient and attractive. Vaping is also widely accepted within friend groups, while in contrast, one student described traditional cigarettes as “gross and unattractive” (USD Student, personal communication, December 7, 2022).

Moreover, college students may prefer vaping over cigarette smoking due to the social norms on campus. In most cases, vape use is more accepted than smoking on college campuses. This may be partly due to the fact that many colleges have implemented tobacco-free policies, which prohibit smoking but do not necessarily prohibit the use of vapor products (Truth Initiative, 2019). Vaping is also more discrete, with some students using vapor products in university buildings behind closed doors. This is especially true in bar environments. At the

## DISCREPANCIES IN THE ESTIMATION OF VAPING RATES AMONG COLLEGE STUDENTS

University of South Dakota, students may view vaping as a more socially acceptable and simpler alternative to smoking while consuming alcohol indoors.

To assess smoking rates among college students, various organizations survey college populations yearly. Numerous surveys have been conducted over the years to collect data on smoking habits and attitudes. This data is then compiled and utilized by various parties. Using survey data, public health officials, researchers, and policymakers work to understand vapor product use and develop targeted educational interventions. Survey data is also retained and used in trend evaluations (Farsalinos et al., 2014).

For vaping rates to be assessed, data must be collected. The National College Health Assessment (NCHA) was created to fulfill this need and many others. The NCHA is a survey developed by the American College Health Association (ACHA) to collect data from college populations across the United States. The survey, termed the NCHA, has been administered to college students for over 20 years. Its data has become the basis for a multitude of research topics, from alcohol consumption to sexual activity. The survey is typically administered online to a representative sample of students at various colleges and universities. This survey includes questions about a variety of health topics, including vaping (American College Health Association, n.d.).

The NCHA asks students about their use of traditional cigarettes and e-cigarettes or vapes, as well as their perceptions and attitudes toward these products. Researchers and public health officials have used the data collected from the NCHA on vaping rates to track trends in nicotine vapor product use among college students and inform interventionists (American College Health Association, n.d.).

## DISCREPANCIES IN THE ESTIMATION OF VAPING RATES AMONG COLLEGE STUDENTS

In 2019, the NCHA surveyed nearly 200,000 college students in total from more than 200 campuses across the United States. This vast survey found that the use of nicotine vapor products among college students has recently increased. According to the National College Health Assessment, from 2021 to 2022, previous nicotine delivery product use increased from 30.3% to 33.1%. In 2019, 36.9% of surveyed college students reported using nicotine vapor products in just the past 12 months, compared to 27.8% in 2017 (American College Health Association, 2019). Vapor products are a relatively new nicotine product; this makes any uptick in use very concerning.

Increases in vaping rates among college students have also been shown in other surveys, including the Monitoring the Future survey conducted by the University of Michigan, and the National Youth Tobacco Survey, a yearly study conducted by the Centers for Disease Control and Prevention (Johnston et al., 2021). Increases across the board should be the basis for further research.

These surveys are among thousands conducted by various organizations. For the purpose of this thesis, the NCHA will be focused upon. The NCHA assesses only college students. In the Spring 2022 release, the study analyzed over 65,000 individuals (American College Health Association, 2022). Its survey method and collected data are used in an array of studies and are respected by the scientific community.

Nevertheless, the accuracy of all vaping surveys has been called into question, with some experts suggesting that they may not provide an accurate portrayal of smoking habits among college populations. Others have stated possible inaccuracies of smoking surveys in college



## DISCREPANCIES IN THE ESTIMATION OF VAPING RATES AMONG COLLEGE STUDENTS

populations might be caused by social desirability bias as well as inconsistent definitions of vaping (Brennan et al., 2017). I believe social desirability is a significant cause of inaccuracies.

Social desirability bias is a type of bias where in some cases, individuals provide answers to questions that they believe are more socially acceptable rather than reflecting their actual attitudes or behaviors. This can significantly impact the accuracy of surveys related to health behaviors, including vaping surveys. Vaping surveys often rely on self-reported survey data, where participants are asked to report their nicotine use. Due to social desirability bias, some individuals may not always provide honest responses and may modify their answers to make themselves look or feel better. For example, a college student may be unwilling to admit to frequently vaping, as it may be seen as socially undesirable or stigmatized by the surveyor. Social desirability bias might therefore lead to the underestimation of actual vaping rates.

In one study conducted by Brennan et al., researchers found that among a sample of college students, individuals who reported vaping were more likely to underestimate their nicotine use than those who reported cigarette smoking. This means those who vape are less likely to be honest about their nicotine use (Brennan et al., 2017). In addition, participants who reported higher levels of social desirability bias were also more likely to make dishonest reports. This study may suggest that social desirability bias may skew vaping surveys more than other health behavior surveys. This would lead to an underestimation of nicotine inhalation product use.

Inconsistent definitions of vaping may also play a part in vaping survey inaccuracies. There is no single accepted definition of vaping. Vaping definitions can vary by study, country, and regulatory body. This variation in definitions makes it difficult to measure the prevalence of

## DISCREPANCIES IN THE ESTIMATION OF VAPING RATES AMONG COLLEGE STUDENTS

vaping among populations. Some studies define vaping as the use of any electronic nicotine delivery system (ENDS), while other studies only consider the use of e-cigarettes or vapes. Additionally, some studies only include nicotine-containing e-cigarettes, while others include non-nicotine-containing e-cigarettes. With other vapor products on the rise, this can be an issue. The study that defined vaping as the use of ENDS found that the prevalence of vaping among US adults was 4.2% in 2016 (Mirbolouk et al., 2018). Another study that defines vaping as the use of e-cigarettes found that the prevalence of vaping among US adults was 10.8% in 2014 (King et al., 2015).

Definitions of vaping also vary by country. For example, in the UK, e-cigarettes are defined as “Products that vaporize a liquid that contains nicotine.” In contrast, in the US, e-cigarettes are defined as “products that deliver nicotine in a vapor form” (Office for National Statistics, 2019). These slight differences in definitions make comparisons challenging. These inconsistent definitions lead to inconsistent results.

Accurate data on vape usage is crucial for effective public health policy. However, definitional inconsistencies and various biases may lead to inconsistencies and inaccuracies in current rate estimations. This potential for flawed data exhibits the need to identify and address these limitations to inform all parties best. For these reasons, I created a survey focused on eliminating social desirability bias and collected observational data.

To continue this study, I will first discuss the methodology incorporated into the study. I will then discuss the various limitations of the study. Next, I will display the results of the survey and observational data. Finally, I will discuss the results and conclusions drawn from the study.

## CHAPTER TWO

### Research Methodology

#### Research Strategy and Design

This study investigates vaping rates in the college population at the University of South Dakota to allow for a comparison with the official statistics on national vaping rates among college students. To assess vaping rates at USD, I created a survey and collected observational data. Crucially, my survey was designed to limit the type of social desirability bias that may be affecting the official statistics. Observational data was collected in a “college-age bar” where individuals are free to vape. This data represents the direct observation of college student’s behavior. As such, it is unaffected by some of the forms of bias in reporting that can affect survey data.

The survey was sent via email to various groups at USD in an effort to collect an optimally representative sample of the entire USD population. Respondents included: individuals from various athletic groups, sorority and fraternity life, the university honors program, and various student organizations. The survey was only distributed to USD students and contained 12 multiple-choice questions that took less than two minutes to complete. The questions collected information about nicotine vapor product use, cigarette use, and monthly bar attendance. The survey also collected demographic data. The survey was distributed in electronic format via Qualtrics. Electronic distribution was found to be the easiest method of distribution. Qualtrics was used to both construct the survey and collect data from participants. The thesis committee and I received IRB approval for the survey and observational study prior to data collection. Due to the method of distribution, there was no way to identify how many students received the

## DISCREPANCIES IN THE ESTIMATION OF VAPING RATES AMONG COLLEGE STUDENTS

survey. There was also no identifying information collected in the survey, keeping individuals anonymous.

The intent of the survey was to collect data from the USD population on vaping rates. The survey, being distributed by a college student, was intended to limit social desirability bias. In theory, this would allow college students to report their nicotine habits more accurately. According to Brennan et al., participants may respond in a way to please the researcher or meet societal norms (Brennan et al., 2017). Coming from a peer, this survey may allow college students to answer the questions with lessened social desirability bias. The questions were kept simple. The survey was also created to be short so respondents did not tire and select inaccurate choices. The full text of the survey is available for viewing in the appendix.

The observational study data was collected at a college-age bar. In Vermillion, college students vape freely while consuming alcohol in bars. Management rarely apprehends an individual who is using a nicotine vapor device indoors. Vaping is seen as a convenient, attractive, and accepted form of nicotine use. While working at a Vermillion bar, on two separate occasions, I observed 75 individuals and recorded whether each person used a nicotine vapor device while in the bar. I first recorded how many people I was observing at each table as a bartender. I then recorded whether each individual vaped while they were within my sight. The setting was casual, and patrons could vape as they pleased without confrontation. The intent of this portion of the study was to observe nicotine use in an unrestricted college-age environment. Individuals were observed for the entire duration of their stay at the bar. The length of their stay was not controlled.

# DISCREPANCIES IN THE ESTIMATION OF VAPING RATES AMONG COLLEGE STUDENTS

The intent of the entire study was to collect vaping data to compare to vaping data collected by large organizations. If large differences in percentages of college students using nicotine vapor products were found, further research would be suggested.

## **Limitations**

This study's methodological approach does have some limitations. The vaping usage rates from this study's survey will be compared with the results from the National College Health Assessment (NCHA). One limitation is that the population taking the NCHA and the population surveyed at USD are different. Both survey populations are meant to be random samples of college students. However, survey distribution methods and geographical collection areas are different. The NCHA collects data from an array of United States colleges in an effort to obtain a representative sample of United States College students, whereas this study was conducted only at USD. Different locations may differ in vaping rates. This could cause natural variation in the results of the two surveys. These surveys, both cross-sectional studies, were also taken at different times. The NCHA study was conducted in the spring of 2022, while the survey for this study was distributed in the early months of 2023. This could cause the results to differ from one another.

Due to selection bias, the random sample of individuals who took the survey or were observed in the bar may not perfectly represent the USD population. The survey sample collected was sent to various lists in the best attempt to collect a representative sample. The observed individuals in the bar were only observed while they were present in one bar. They may have vaped before they entered the area of observation. This could cause observational vaping

## DISCREPANCIES IN THE ESTIMATION OF VAPING RATES AMONG COLLEGE STUDENTS

rates to be lower than the actual rates. Additionally, bar-goers may not accurately represent the entire USD population. This could cause vaping rates to differ between bar-goers and non-bar-goers.

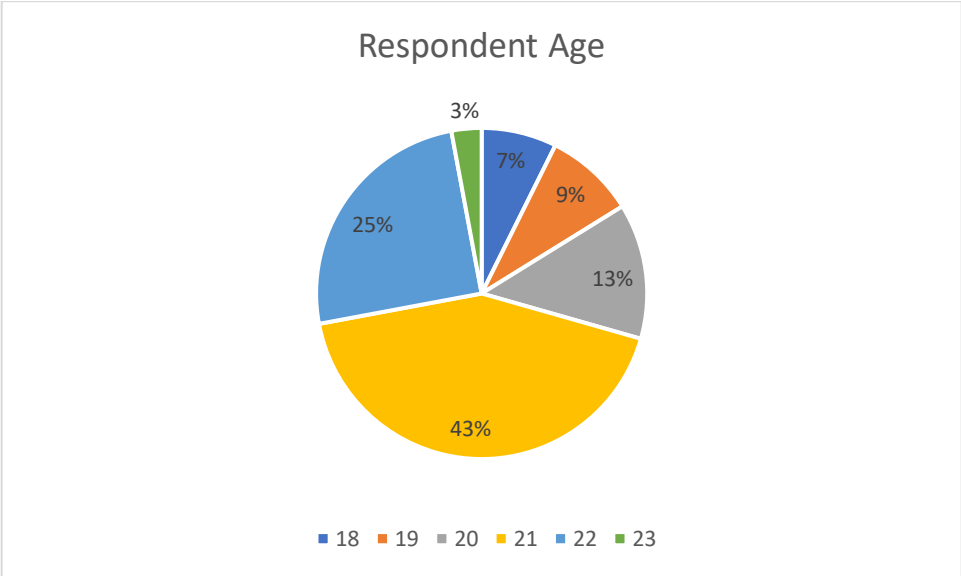
In summary, the results from these two surveys (mine and the NCHA's) are not perfectly comparable, while the data collected in the observational study may not accurately represent the USD population. For this reason, this study's results are intended to be suggestive rather than conclusive.

**CHAPTER THREE**  
**Results**

**Survey Demographics**

Seventy-seven individuals responded to the electronic survey. Of those, 9 or 11.69% of the responses were omitted from analysis due to incompleteness or answering “no” to the question, “Are you a current college/university student?” All the remaining responses were from current college or university students.

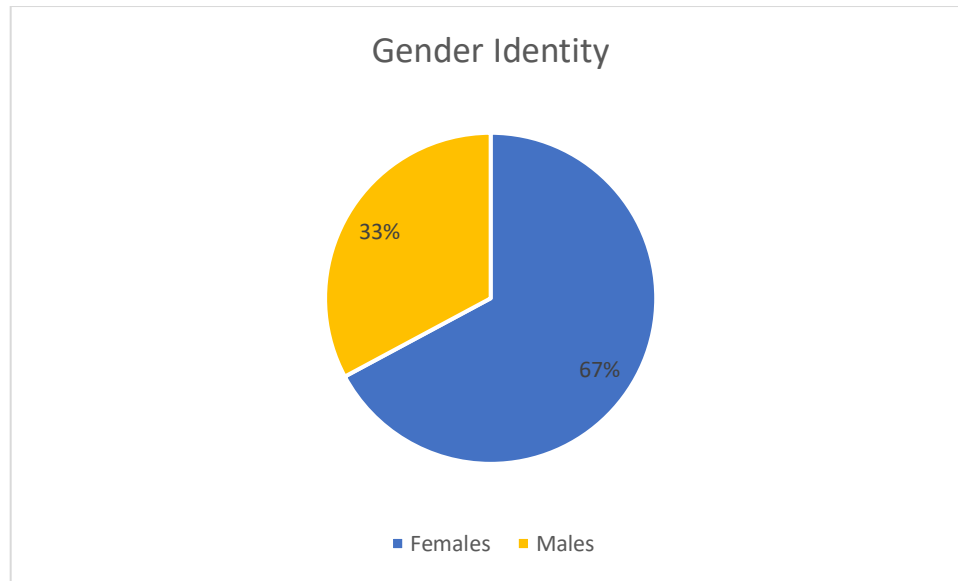
I first analyzed the demographics of the participants. An array of students participated in the survey.



**Figure 1: Respondent Age**

# DISCREPANCIES IN THE ESTIMATION OF VAPING RATES AMONG COLLEGE STUDENTS

The responses came from students 18 to 23 years of age. A greater percentage of participants were ages 21 and 22 than any other age. The average respondent age was 20.8 years old.



**Figure 2: Gender Identity**

Thirty-three percent of respondents were male, while 67% were female. This response ratio was similar to the overall ratio of males to females at the University of South Dakota, which is 37:63 (Forbes, n.d.). Significantly, this ratio was similar to the ratio of male to female respondents to the NCHA, with which this survey data will be compared. The participant's household income and background were also collected but not used in comparisons to the NCHA.

The demographics of the two studies varied but were not widely different. In 2022, the National College Health Assessment was completed by 68,085 participants. The NCHA had a wide age range, with 46.0% of respondents being 18- 20 years of age, 33.2% being 21-21, 10.4% being 25-29, and 10.4% being 30+ years of age, respectively. The average age of the group was



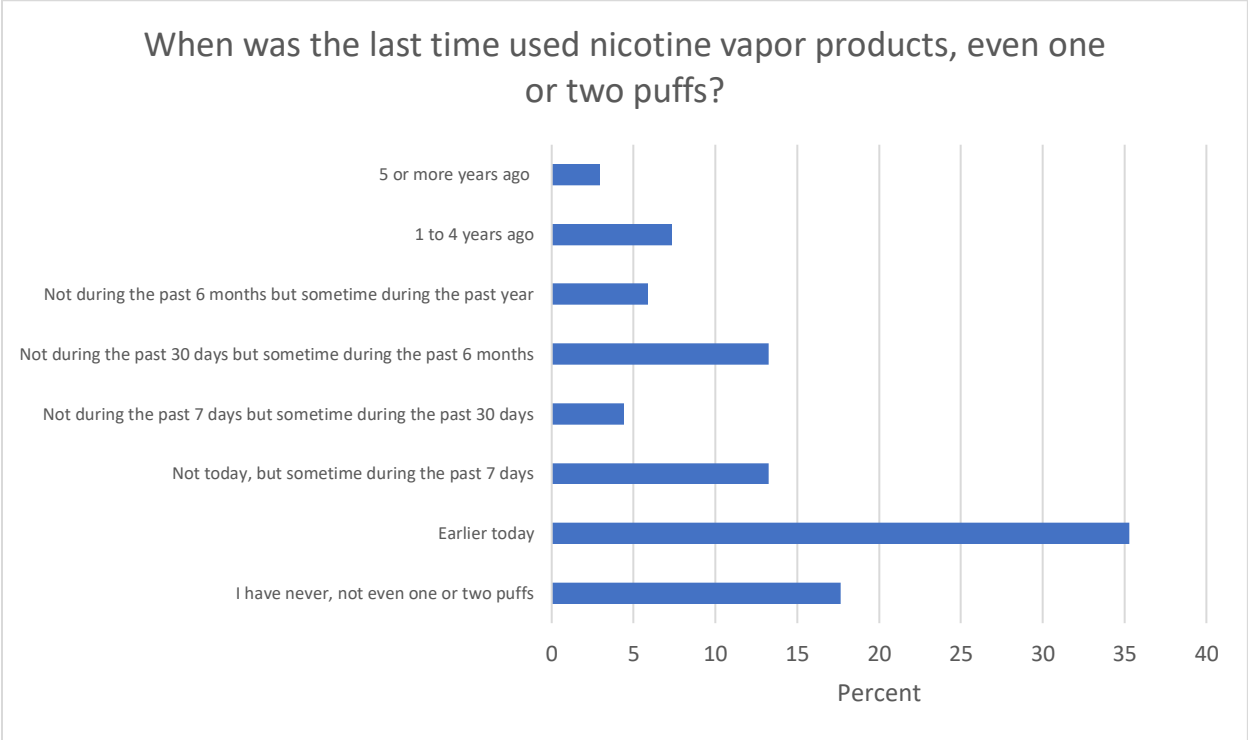
## DISCREPANCIES IN THE ESTIMATION OF VAPING RATES AMONG COLLEGE STUDENTS

22.9 years (2.1 years older than the surveyed sample in this study). The group was made up of 28.2% males, 65.9% females, and 5.9% trans/gender non-conforming. This sample, like the one collected from the University of South Dakota, had a much greater number of females than males and trans/gender non-conforming individuals. This made little difference, as each gender differed by less than .2% in e-cigarette use in the NCHA survey.

### **Main Survey Findings**

Next, I assessed the data collected regarding vaping and tobacco use. Participants were asked whether they had ever tried nicotine vapor products. 55 out of the 68 participants, or 80.9%, had tried a nicotine vapor product at some point in their life. Next, participants were asked when the last time they used nicotine vapor products was. 52.9% of participants had used a nicotine vapor product within the last three months, while 35.3% of participants answered they had used one earlier that day. Results from all response options can be seen in Figure 3.

DISCREPANCIES IN THE ESTIMATION OF VAPING RATES AMONG COLLEGE STUDENTS



**Figure 3: Nicotine Vapor Product Use**

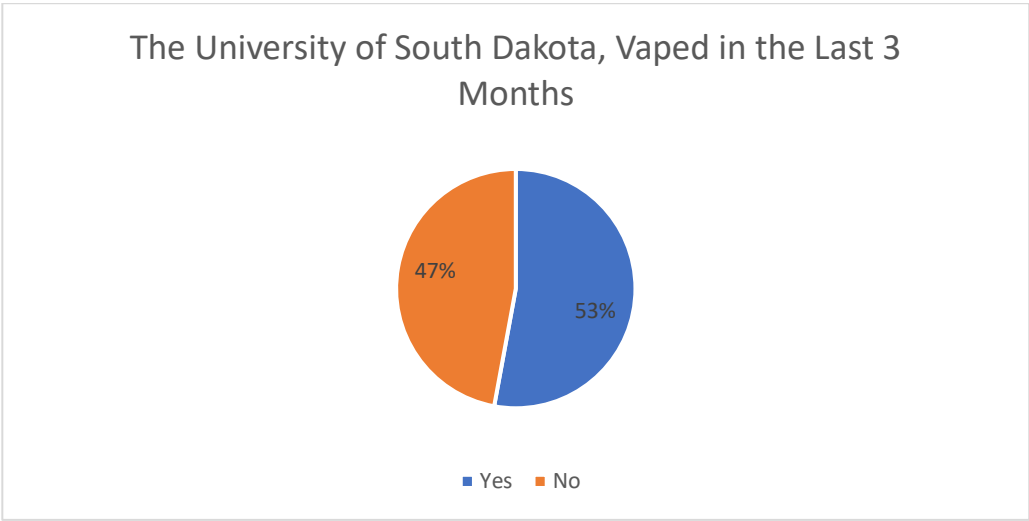
**National College Health Assessment Data**

The NCHA found 16.5% of individuals had used a nicotine vapor device within the last three months. The survey also found that 33.2% of the study population had tried “Tobacco or nicotine delivery products (cigarettes, e-cigarettes, Juul or other vape products, water pipe or hookah, chewing tobacco, cigars, etc.)” at some point in their lives (American College Health Association, 2022).

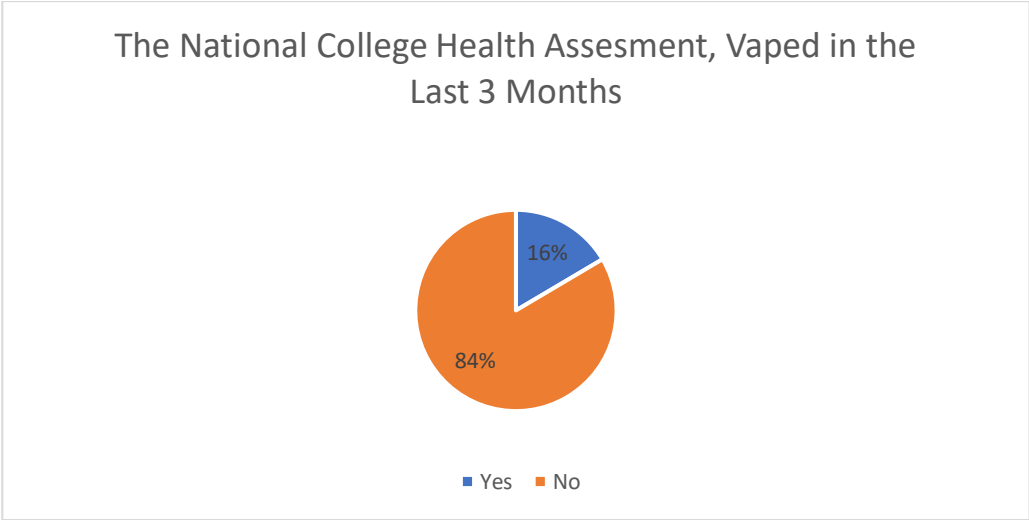
**Comparison of this Study’s Survey Results with those of the National College Health Assessment**

DISCREPANCIES IN THE ESTIMATION OF VAPING RATES AMONG COLLEGE  
STUDENTS

The results of the vaping survey performed at the University of South Dakota differed from the results of the NCHA. In the University of South Dakota survey, 52.9% of participants had used a nicotine vapor product within the last three months, while the NCHA found that just 16.5% of individuals had used a nicotine vapor device in the same amount of time. This comparison can be seen in the difference between Figure 4 and Figure 5.



**Figure 4: Individuals Who Vaped in the Last 3 Months at The University of South Dakota**



**Figure 5: Individuals Who Vaped in the Last 3 Months in the NCHA**

The USD result was found to be significantly different from the NCHA finding, using a z-test.

The following formula was used for this hypothesis test.

$$z = \frac{\hat{p} - p_0}{\sqrt{\frac{p_0(1 - p_0)}{n}}}$$

In this calculation,  $\hat{p}$  is the sample proportion of surveyed individuals who had vaped in the last three months,  $p_0$  is the proportion of all United States college students who had vaped in the last three months, and  $n$  is the number of responses to my survey. If  $z$  was greater than 1.645, the results would be significantly different statistically.  $Z$  was found to be 8.09, meaning that the likelihood that my survey data were drawn from a college population in which the true rate of 3-month vaping usage was 16.5% (as reported by the NCHA) is infinitesimally small. The calculation can be seen below.

$$z = \frac{.529 - .165}{\sqrt{\frac{.165(1 - .165)}{68}}}$$

Using this formula does violate some assumptions that the hypothesis relies upon. Firstly, the USD survey drew from a different population than the NCHA survey. One was from the University of South Dakota, while the other was collected nationally. Secondly, my survey respondents were not a simple random sample of all USD students. My sample was a best attempt to collect a random sample but cannot be guaranteed to be perfectly random. Fortunately, however, the demographic characteristics in terms of age and gender closely paralleled those of the NCHA sample, making the two samples more comparable. In addition, and as will be discussed below, statistical data collected by others suggests that vaping usage rates in South

## DISCREPANCIES IN THE ESTIMATION OF VAPING RATES AMONG COLLEGE STUDENTS

Dakota are roughly equivalent to the national average; there is, therefore, no reason to think that regional variation should explain the large discrepancy between the NCHA result and the vaping usage rate found here.

### **Bar Observational Data**

Seventy-five individuals who appeared to be of college age were observed in a Vermillion bar. This observation occurred on two occasions. Thirty-eight individuals were observed on the first night, while 37 were observed on the second night. On night one, 21 of 38 individuals used a vapor product at least once while in view. This means 55.2% of observed individuals vaped while in the bar. On night two, 19 of 37 individuals vaped while in view, for a total of 51.4%. Adding the nights together, 40 of 75 individuals vaped while in view, for a total of 53.3%. This result is even higher than the result of the vaped “Earlier today” option in my USD survey. That result yielded 35.29%.

Survey participants were asked the question, “Does alcohol affect your nicotine vapor product usage?” 66.2% of participants answered yes. This may partially explain the slightly elevated vaping rate among bar-goers. Overall, the observational data suggests that vaping usage among college students is indeed high.

## CHAPTER FOUR

### Discussion and Conclusion

This study has explored the possibility that national statistics are underestimating vaping rates among college students by examining vaping rates in the college population at the University of South Dakota, using both a survey and ethnographic observation. The survey conducted as part of this study found that at USD:

- 35.29% of students vape daily, and
- 52.9% of participants had used a nicotine vapor product within the last three months.

Usage rates were much higher than prior national surveys have found. Whereas this study found that 52.9% of students had vaped within the past three months, the NCHA found this was true of only 16.5% of college students. Even with the many limitations of this study, this large difference is not likely to be random and does cast doubt upon established statistics.

Observational data lends further credibility to the study's survey-based finding of much higher-than-expected vaping rates: while observed, 53.3% of college-age individuals at a local bar used a vaping product.

Note that South Dakota is close to an average state in terms of nicotine use. According to Insurify and the CDC, South Dakota is the middle of the line when it comes to vaping. In 2018, the CDC data claimed between 8 and 9% of individuals aged 18 to 24 used e-cigarettes. This is in comparison to states like Colorado, which reported 17% usage in 2018 (Insurify, 2022).

## DISCREPANCIES IN THE ESTIMATION OF VAPING RATES AMONG COLLEGE STUDENTS

The data collected in this study suggests that vaping rates are significantly higher than what is currently reported by expert organizations, including the NCHA (which measures vaping rates among college students specifically) but also large public health organizations like the U.S. government's Food and Drug Administration, which reports similar vaping rates for the 18-24 age group more generally (U.S. Food and Drug Administration, 2022). Results suggest that the NCHA and other statistics-gathering organizations may be underestimating vaping rates because of the limitations of current survey methods, such as social desirability bias. My survey was focused on the reduction of social desirability bias. The survey was also short to reduce fatigue and elicit accurate responses. My research suggests the methods utilized in my study collected data with different vaping rates compared to data collected by large organizations.

College-age populations are particularly susceptible to taking up nicotine use during their college years for various reasons. This can then become an addiction that lasts a lifetime. This is one of the many reasons survey data must be accurate. Accurate survey data allows public health and government officials to effectively address problems such as this. Without accurate data, vaping may never be considered the issue it actually is.

In summary, the findings of this study suggest that vaping rates among college students are much higher than what current data claims. It also suggests that current survey methods need to be addressed to develop more accurate data-collection methods. Addressing the issue of smoking survey inaccuracies in college populations will take a multifaceted approach, including in-depth research on addressing survey biases. Nevertheless, collecting accurate data for problems like this is critical. By understanding the extent of the problem and developing more

DISCREPANCIES IN THE ESTIMATION OF VAPING RATES AMONG COLLEGE  
STUDENTS

effective interventions, policymakers and public health officials can work towards reducing the negative impacts of nicotine inhalation products on public health in college populations.



# DISCREPANCIES IN THE ESTIMATION OF VAPING RATES AMONG COLLEGE STUDENTS

## APPENDIX

Qualtrics Survey Software

<https://southdakota.az1.qualtrics.com/Q/EditSection/Blocks/Ajax/GetS...>

### Default Question Block

You are invited to participate in a research study. The purpose of this survey is to gather information about smoking/vaping habits in college-age populations. The goal of this survey is to collect more accurate information about smoking rates in college populations ages 18 to 24, and should take you less than 5 minutes to complete. This data will be interpreted by college student, and undergraduate research assistant, Cameron Klug. All your data will remain completely anonymous.

For this study to be beneficial and worthwhile, we need your honest answers. Please answer each question honestly to the best of your knowledge. This survey does not involve any foreseeable risk to you and there are no direct benefits. Participation in this study is completely voluntary.

If you no longer wish to participate, please exit the survey now. The survey is being conducted by faculty and students at the University of South Dakota. If you have any questions about this study, please contact Louisa Roberts, Assistant Professor of Anthropology and Sociology (Louisa.Roberts@usd.edu). If you have questions about your rights as a research participant, please contact Marc Guilford, IRB Manager, University of South Dakota Institutional Review Board (605-658-3767 or humansubjects@usd.edu). Thank you for your participation. By clicking proceed you affirm that you are a student ages 18 to 24 and consent to your anonymous data being collected.

Proceed

### Block 1

# DISCREPANCIES IN THE ESTIMATION OF VAPING RATES AMONG COLLEGE STUDENTS

Qualtrics Survey Software

<https://southdakota.az1.qualtrics.com/Q/EditSection/Blocks/Ajax/GetS..>

The first questions ask for some background information about you. Your data will not be linked or reversed to determine your identity.

How old are you?

- 18
- 19
- 20
- 21
- 22
- 23
- 24

What is your sex?

- Male
- Female
- Other
- Prefer not to say

What is your parent's household income?

- Below \$10,000
- \$10,000 to \$50,000
- \$50,000 to \$100,000
- \$100,000 to \$150,000
- More than \$150,000
- Unsure

# DISCREPANCIES IN THE ESTIMATION OF VAPING RATES AMONG COLLEGE STUDENTS

Qualtrics Survey Software

<https://southdakota.az1.qualtrics.com/Q/EditSection/Blocks/Ajax/GetS...>

Which of the following backgrounds do you identify with? (select all that apply)

- White
- Black or African American
- American Indian or Alaska Native
- Asian
- Native Hawaiian or Pacific Islander
- Other

Are you a current college/university student?

- Yes
- No

## Block 2

The next questions in this survey will ask about your use of nicotine products. The questions refer to all nicotine products but do not include other inhalable products.

Have you ever tried vaping, even one or two puffs?

- Yes
- No

When was the last time used nicotine vapor products, even one or two puffs?

- I have never, not even one or two puffs
- Earlier today
- Not today, but sometime during the past 7 days
- Not during the past 7 days but sometime during the past 30 days
- Not during the past 30 days but sometime during the past 6 months
- Not during the past 6 months but sometime during the past year
- 1 to 4 years ago
- 5 or more years ago

When was the last time used cigarettes, even one or two puffs?

- I have never, not even one or two puffs
- Earlier today
- Not today, but sometime during the past 7 days
- Not during the past 7 days but sometime during the past 30 days
- Not during the past 30 days but sometime during the past 6 months
- Not during the past 6 months but sometime during the past year
- 1 to 4 years ago
- 5 or more years ago

During the past 30 days, on how many days did you use nicotine vapor products?

- 0 days
- 1 or 2 days
- 3 to 5 days
- 6 to 9 days
- 10 to 19 days
- 20 to 29 days
- All 30 days

# DISCREPANCIES IN THE ESTIMATION OF VAPING RATES AMONG COLLEGE STUDENTS

Qualtrics Survey Software

<https://southdakota.az1.qualtrics.com/Q/EditSection/Blocks/Ajax/GetS..>

Does alcohol affect your nicotine vapor product usage?

- Yes
- No

During the past 30 days, on how many days did you visit a bar?

- 0 days
- 1 or 2 days
- 3 to 5 days
- 6 to 9 days
- 10 to 19 days
- 20 to 29 days
- All 30 days

Powered by Qualtrics

DISCREPANCIES IN THE ESTIMATION OF VAPING RATES AMONG COLLEGE  
STUDENTS

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