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ASSESSING E-CIGARETTE'S KNOWLEDGE AND PRACTICES AMONG COLLEGE STUDENTS AMID COVID-19 PANDEMIC

Isaac Mendez Acosta

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ASSESSING E-CIGARETTE'S KNOWLEDGE AND PRACTICES AMONG
COLLEGE STUDENTS AMID COVID-19 PANDEMIC

A Thesis
Presented to the
Faculty of
California State University,
San Bernardino

In Partial Fulfillment
of the Requirements for the Degree
Master of Public Health

by
Isaac Mendez Acosta

May 2022

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ABSTRACT

Background: E-cigarettes are a relatively new form of smokeless tobacco that has gained significant popularity in the past decade (American Lung Association, 2020). These products contain several harmful chemicals and compounds that can have long-term health effects. Among college students, *knowledge* and *attitude* have a large impact on the E-cigarette practices among this population and hence the need to address it is essential, especially with the possible impact that COVID-19 has had on many.

Methods: This study utilized a qualitative research method to gather data that is focused on the Knowledge, Attitude, and Practices of college students relating to E-cigarette usage. A 14-question survey was developed using the KAP model and distributed electronically to three different introductory health science courses. Following the distribution of the survey, a voice recorded PowerPoint containing evidence-based education and resources on E-cigarettes was distributed to the instructors to provide an educational resource to surveyed participants. The results of this study were analyzed through SPSS statistical analysis version 27.0 and Microsoft Excel version 2013.

Results: Findings from this study suggests that the majority of participants (93.2%) were aware that E-cigarettes could be harmful to their health. However, 31% of participants considered E-cigarettes to be either somewhat harmful or a little harmful. Furthermore, 33.8% of the participants stated they strongly agreed, agreed, or were neutral to the statement that *E-cigarettes are safe when*

compared to regular cigarettes. This study also found that third year students had the highest rates of E-cigarette use among participants totaling 55% of all users. Finally, this study found that 27.0% of participants had used E-cigarettes at least once in their lifetime. Since the start of the COVID-19 pandemic, 6.8% of E-cigarette users stated that they had seen an increase in their usage of these products.

Conclusion: This study aimed to assess for the Knowledge, Attitude, and Practices of E-cigarette use among college students at a public university in Southern California during the COVID-19 pandemic. The results suggest that there is currently a gap in knowledge relating to E-cigarettes that needs to be addressed. Many study participants were unsure of the addictive properties of E-cigarettes and considered these products to be safe when compared to traditional cigarettes. Furthermore, there is a possible relationship between COVID-19 pandemic and increased or continued use of E-cigarettes that merits further study. The use of evidence-based education among this population is highly recommended to discourage consumption among college students.

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TABLE OF CONTENTS

ABSTRACT	iii
ACKNOWLEDGEMENTS.....	v
LIST OF TABLES	vii
LIST OF FIGURES	viii
CHAPTER ONE INTRODUCTION	1
Problem Statement	1
Purpose of Study	4
Research Questions.....	5
Significance to Public Health	5
CHAPTER TWO LITERATURE REVIEW.....	7
Knowledge.....	7
Attitude.....	9
Practice.....	10
COVID-19	12
CHAPTER THREE METHODS	13
Study Design	13
Data Source and Collection	13
Measures.....	14
Data Analysis.....	14
Ethics.....	14
CHAPTER FOUR RESULTS.....	15
Research Question 1	17

Research Question 2	19
Research Question 3	20
Research Question 4	23
CHAPTER FIVE DISCUSSION	26
Strengths and Limitations	29
Recommendations for Research and Practice.....	30
Conclusion	32
APPENDIX A INSTITUTIONAL REVIEW BOARD APPROVAL FORM.....	33
APPENDIX B Survey questions.....	35
REFERENCES	39

LIST OF TABLES

Table 1: Demographic characteristics of the respondents	16
Table 2: An Assessment of Knowledge regarding harmful chemicals found inside E-cigarettes.	17
Table 3: The relationship between E-cigarette use and respondents' Academic Standing Levels.	19
Table 4: E-cigarettes Practices among study participants.	23

LIST OF FIGURES

Figure 1: An assessment of Knowledge and the Harms of using E-cigarettes using a Likert scale.....	18
Figure 2: An assessment of Attitude towards the addictiveness of E-cigarettes using a Likert Scale	20
Figure 3: An assessment of Attitude towards E-cigarettes compared to regular cigarettes using a likert scale.....	21
Figure 4: Assessing E-cigarettes Practices (use) during COVID-19 pandemic.	24

CHAPTER ONE

INTRODUCTION

Problem Statement

Electronic cigarettes, or E-cigarettes, are a newer form of smokeless tobacco product that has seen an increase in popularity, particularly among younger people, in the past few years (American Lung Association, 2020). E-Cigarettes are devices that use a battery to heat a liquid, typically containing nicotine, into an aerosol that is then inhaled by the user directly to the lungs (CDC, 2021b). This aerosol can contain several harmful substances within it, including dangerous and addictive chemicals such as Nicotine and Diacetyl, volatile organic compounds, and heavy metals such as lead, tin, and nickel (CDC, 2021b). Nicotine, in particular, is a highly toxic chemical that is not only addictive but also been shown to harm the development of the brain, affecting the way the synapses are formed, particularly in younger people (CDC, 2022). Further, this can harm the parts of the brain in control of attention, mood, learning, and impulse control (CDC, 2022). Given their relatively recent introduction to the marketplace, the long-term health effects of E-cigarette use are still being researched. However, many of the chemicals and substances stated above may increase disease risk over the long-term, particularly when consumption begins at an earlier age (CDC, 2021b).

Since 2014, the overall E-cigarettes usage rate for adults has gone down slightly from 3.7% to 3.2% in 2018 (Truth Initiative, 2021). On the other hand,

since 2011, an increase among middle school students has been reported from 0.6% to 10.5% of users indicating an increase of 1650% (American Lung Association, 2021). Similarly, high school students have seen an increase in usage of 1733% from 1.5% to 27.5% (American Lung Association, 2021). In 2019, the Surgeon General stated that the usage of E-cigarettes has become an epidemic among the nation's young population and aggressive steps would need to be taken to prevent a new generation of smokers (CDC, 2019).

Owing to a lack of knowledge, young adults, ages 18-24 years also saw a significant increase in the usage of E-cigarettes, rising from 2.4% in 2012, up to 7.6% in 2018 (Truth Initiative, 2021). A national survey conducted by the National Institute on Drug Abuse (NIDA) found that using E-cigarettes use among college students increased from 6.1% to 22% (USDHHS, 2020b). Among young adults, White non-Hispanic men aged 18-24 had the highest prevalence of E-cigarette usage. Furthermore, young adults between 18-35 years old were more likely to use another tobacco product alongside E-cigarettes increasing their odds of daily cigarette use 1.67 times (Truth Initiative, 2021). This study will focus on college students given that previously studied populations may mirror similar attitudes and behaviors.

While the health effects of long-term use of E-cigarettes have not been observed, the increased usage rates by college students is concerning as more students begin using these products every day. From August 2019 to January 2020, the age group of 18-24 accounted for the highest number of both deaths

and hospitalizations among all age groups related to lung injuries caused by E-cigarette use (CDC, 2020). This may be due to a lack of ample knowledge regarding the health effects of E-cigarettes, something that likely affects their attitudes towards this product. “As a result, the Centers for Disease Control and Prevention (CDC), the U.S. Food and Drug Administration (FDA), and accompanying state and local health departments, together with other clinical and public health partners, have been investigating E-cigarettes as a potential cause of widespread lung illnesses that have resulted in a national outbreak” (Mshigeni, 2021, p. 17).

Currently many college students use E-cigarettes for a variety of reasons. A study conducted in 2016 found that use for enjoyment, trying something new, and the perception that E-cigarettes are less toxic were some of the top reasons that college students consumed these products (Saddleson et al., 2016). Further, NIDA also found that many college age students perceive E-cigarettes as a safer alternative to traditional cigarettes without realizing that the amount of nicotine they contain may be highly addictive and damaging to their developing brains (USDHHS, 2020a). The leading reason for usage of E-cigarettes among young adults was the variety of appealing flavors with 90.3% citing it as their main reason for usage (Truth Initiative, 2021). A study found that some college students were less aware of some of the health risks that E-cigarettes pose, with many believing that E-cigarettes are composed mostly of water vapor (Katz, 2020). In fact, one of the study participants stated: “instead of smoke, it’s a vapor

and um I'm not sure if that gives extra health benefits, it seems like it would... not inhaling smoke, you're just inhaling water vapor" (Katz, 2020 p.82). This same study also found that many of the participants were unconcerned with the presence of nicotine in these products, expressing that the possibility of addiction was not something to be concerned about (Katz, 2020).

Further research suggests that college-aged students who currently use flavored tobacco are at a greater risk of contracting COVID-19 due to the increase in potentially infected droplets produced by the user (Singh et al., 2020). According to the Truth Initiative (2020), in 2020, young adult E-cigarette users, between the ages of 13-24, were 5 times more likely to test positive for COVID-19 when compared to nonusers. As such, conducting research and providing education on the prevalence of E-cigarettes use, as well as related knowledge, attitudes, and practices among college students (18-24) is imperative to improving health outcomes for this population.

Purpose of Study

The purpose of this study was to conduct a cross-sectional study to examine Knowledge, Attitude, and Practices (KAP) regarding E-cigarettes among college students from one public university in Southern California.

Research Questions

1. What is the current knowledge and understanding that college students have regarding E-cigarettes?
2. Among college students, is there a correlation between E-cigarettes use and one's academic standing level?
3. What is the current attitude towards E-cigarettes among college students?
4. What is the impact that the COVID-19 pandemic has had on the practices of E-cigarettes use among college students?

Significance to Public Health

E-cigarette usage is a relevant topic for the field of public health given its widespread acceptance among various age groups in the past several years (American Lung Association, 2020). Several of the substances found within E-cigarettes are harmful to the body and have already led to hospitalizations and deaths (CDC, 2020). While several studies and surveys have analyzed the knowledge, attitude, and practices of youth (minors under 18 years of age) using E-cigarettes, there have been significantly fewer studies focusing on college students. Hence, this study will utilize the KAP model to examine the Knowledge, Attitude, and Practices of E-cigarettes among undergraduate college students.

Furthermore, education on the harmful effects of this product will also occur with the aim to modify the KAP of E-cigarettes within this group.

This Thesis will also incorporate several MPH competencies. It will incorporate: a) the selection of quantitative and qualitative data collection methods appropriate for a given public health context through the collection survey data, b) the analysis of quantitative and qualitative data using biostatistics, informatics, computer-based programming, and software, specifically MS Excel and the Statistical Package for the Social Sciences (SPSS) to analyze the results of the survey, and c) this study will assess population needs, assets, and capacities that affect communities' health by identifying the needs of the group being studied and providing evidence-based education to help fill in any gaps in knowledge pertaining to E-Cigarettes.

CHAPTER TWO

LITERATURE REVIEW

E-cigarettes are a newer form of tobacco delivery, which have been more popular among younger individuals, typically middle and high school students, but the highest number of hospitalizations and death cases have been attributed to the college-aged (18-24 years) group (CDC, 2020a). Lack of Knowledge regarding the threats of E-cigarettes, such as the toxic chemicals and certain health risks associated with them, as well as their Attitude towards the product, and their Practice (e.g., usage) has led to an increased health risk among this age group. Additionally, there are only a number of studies that have analyzed the KAP of college aged students. Through the use of the KAP model, this section describes the current literature regarding E-cigarettes among this population and identifies any missing gaps that may need to be addressed.

Knowledge

A recent study found that 88.4% of college students were aware of E-cigarettes (Wang et al., 2020). However, this same study found that 78.3% of students sampled either did not think E-cigarettes contained carcinogens or were unaware about the chemical compounds contained in those product (Wang et al.,

2020). Additionally, 65.2% of these students were either unsure or did not think E-cigarettes produced harmful second-hand smoke (Wang et al., 2020).

Aqeeli et al. (2020) found that many college students in their sample were unaware of the possible negative health effects of E-cigarettes. Respondents were often incorrect when asked if E-cigarettes were less addictive than traditional cigarettes (51.7%, n = 367/710) and that E-cigarettes were a source of second-hand exposure to nicotine (29.8%, n = 213/716). Furthermore, another study conducted by Jones and others (2020) found that there were differences in knowledge scores between E-cigarette users and non-users. Using average knowledge scores from various E-cigarette-related questions, results showed that those who either never used E-cigarettes or rarely used E-cigarettes had significantly higher knowledge scores when compared to “someday” and “everyday” users (Jones et al., 2020). This study revealed that lower knowledge scores were positively correlated with increased consumption of E-cigarettes.

Additionally, in 2015, a questionnaire was distributed among nursing students regarding their use of E-cigarettes. Canzan (2019) found that the majority of these students were aware of these products and some of the health risks that E-cigarettes posed. Additionally, only 2.1% of the respondents were current E-cigarette users.

It is therefore plausible that increased knowledge about potential negative health effects of E-cigarettes may lead to less usage. In contrast, those who are

not exposed to valid information or exposed to misleading info about these products may be more likely to consume them.

Attitude

Lack of knowledge about E-cigarettes can also influence college student's attitudes towards them, changing how they perceive the risks of these products. Alzahrani et al. (2021) examined medical students' knowledge and attitudes about E-cigarettes and found that 35.9% of participants agreed that E-cigarettes would be a healthier alternative than traditional tobacco products. Additionally, current smokers and ex-smokers were also more likely to be in favor of using E-cigarettes as a smoking cessation aid (Alzahrani et al., 2021).

In another study conducted by Kurdi et al. (2021), an online questionnaire was used to analyze college students' attitudes towards E-cigarettes. They found that 75% of current E-cigarette users believed these products were less harmful than traditional cigarettes. Kurdi et al. further stated that some of the commonly identified reasons for E-cigarette use included: the variety of flavors (60.7%), affordability (39.3%), the use of E-cigarettes as a smoking cessation aid (39.3%), and the appealing image associated with these products (32.1%). This belief that E-cigarettes are less harmful than traditional cigarettes could be a motivating factor for college students to use these products.

A study conducted by Noland et al. (2016) investigated the social influence on the use of cigarettes, E-cigarettes, and hookah among college students and found that E-cigarettes had the second highest level of social

acceptance among all tobacco products. The use of E-cigarettes was perceived to be less risky and many felt they were more likely to use the product since there were fewer laws restricting them in public places (Noland et al., 2016). Another study conducted by Harrell et al. (2017) found that 74% of young adult (18-29) E-cigarette users would not use these products if they have not been flavored. E-cigarette flavors have been one of the most salient factors across many studies regarding the use of E-cigarettes and has affected the college student's attitudes (Truth Initiative, 2021).

Practice

The number of E-cigarette users has continuously grown among all groups since these products were first introduced in 2003. (CDC, 2021b). The highest rate of E-cigarettes usage among young adults aged 18-24 was reported in 2019, with 9.3% claiming to be regular users (Truth Initiative, 2021). In contrast, data from 2012 revealed the usage rates for E-cigarettes was only 2.4%, which indicates an increase of 6.9% in only three years. According to the National Cancer Institute (NIH), in 2017, 6.1% of college students had used E-cigarettes in the past month, which then increased dramatically to 22% in 2019 (USDHHS, 2020b). Jones et.al. (2020) found 24.8% of their sample students either used E-cigarettes in the past or were current users. Loukas et al. (2015) conducted a double wave study surveying 698 students on their tobacco use, knowledge, and attitudes. Between waves 1 and 2, E-cigarette use had doubled

among current smokers and tripled among non-smokers, showing a significant increase among college students (Loukas et al., 2015).

In 2015, a study conducted by Littlefield et al. sampled 599 college students enrolled at a state university on their E-cigarette habits and found that 29% of the students reported prior use of E-cigarettes, with 14% reported smoking in the past 30 days. A study conducted by Sutfin et al. (2013) also found that current cigarette smokers were more likely to use E-cigarettes when compared to non-smokers. Of the students who identified themselves as current cigarette smokers, only 12% had never used any other form of tobacco before (Sutfin et al., 2013). The same study found that male students had higher rates of E-cigarette use compared to other genders (Sutfin et al., 2013). Similarly, a study conducted by Wang et al. (2020) also found that male smokers were more likely to have ever used an E-cigarette when compared to non-smokers.

These studies reveal that E-cigarette use among college students is increasing. Lack of knowledge of the health risks associated with E-cigarettes may be a possible explanation. An uncaring attitude towards potential health risks and other social factors, such as a belief among younger people that E-cigarettes were much safer than traditional cigarettes, have led to a significant rise in E-cigarette use among college students from 6.1% in 2017 up to 22% in 2019 (USDHHS, 2020b). A gap in the literature exists regarding knowledge, attitude, and practice of E-cigarettes, particularly among Hispanic-serving institutions (HSI) with a majority of first-generation students.

COVID-19

Since the start of the COVID-19 pandemic, Gallus et. al (2022) found that E-cigarette use during the strictest phase of the COVID-19 lockdown (April – May 2020), increased from 8.1% to 9.1% among Italian adults. Additionally, the use of E-cigarettes, has been shown to potentially increase the risk for teenagers and young adults to contract COVID-19, when compared to non-users (Digitale, 2020). Gaiha (2020) found that adolescents and young adult smokers, age 13-24, were five times more likely to be diagnosed with COVID-19 compared to non-users. In many cases, using E-cigarettes requires repeated hand to mouth touches. Users even frequently share their applicators, thereby increasing their risk of spreading COVID-19 (Gaiha, 2020).

This study will assess the understanding of E-cigarettes among college students attending an HSI with the goal of providing evidence-based strategies to inform them of the potential negative health effects of E-cigarette usage. This study will add to the existing literature especially regarding the fact that those students are often underrepresented. Students' knowledge, attitudes, and practices regarding E-cigarettes will be assessed and analyzed to see if the current pandemic has had any impact on the use of E-cigarettes among college students.

CHAPTER THREE

METHODS

Study Design

This study carried out a quantitative research method to gather data relating to college student's knowledge, attitude, and perceptions of E-cigarettes. A survey was administered using Google Forms (Mountain View, CA) from the academic institution where the study took place among college students enrolled in introductory courses of Fall 2021 and Winter 2022 semesters. Results were then analyzed using SPSS (Armonk, NY; Ver. 27) and Microsoft Excel (Redmond, WA; Version 2103).

Data Source and Collection

Data were collected from 3 introductory courses offered to undergraduate health science students. Instructors were first contacted via email about their willingness to allow their students to participate in this study and upon their agreement, the information was presented to the university Institutional review Board (IRB). Upon IRB approval, instructors received an email from the researcher with a link to the Google Forms survey accompanied with an educational video. Another email was sent out to instructors containing general

directions for handing out the survey distribution, the IRB approved recruitment script to use, and the link to the survey. After collecting data, instructors were asked to share the educational video to their audiences. The video contained information about the potential health consequences of E-cigarette use. The survey link remained active for 6 weeks, starting November 15th, 2021, through December 27th, 2021. This was done to coincide with the end of the fall semester and beginning of winter intersession in order to increase the number of potential participants.

Measures

The survey consisted of 14 questions including demographic information and prompts to assess students' Knowledge, Attitude, and Practice of E-cigarettes (see Appendix B).

Data Analysis

Data were analyzed using SPSS, version 27.0 and Microsoft Excel, Version 2013.

Ethics

Institutional Review Board (IRB) approval was secured from the university committee (IRB-FY2022-138).

CHAPTER FOUR

RESULTS

In this chapter, an assessment of Knowledge, Attitude, and Practices of E-cigarettes amid the COVID-19 pandemic among college students will be discussed. The demographic characteristics of study participants are shown on Table 1. A total of 74 responses were gathered from undergraduate students enrolled in 4 different lower division classes and 3 laboratory sections during the Fall 2021 and Winter 2022 semesters. The results show that 82.4% of the respondents identified as female and 17.6% were male, were between the ages of 18-21 (60.8%), predominantly Hispanic or Latinx (70.2%), and were in their third year of their university education (39.2%). These findings were consistent with university-wide demographics.

Table 1: Demographic characteristics of the respondents

Variable	Overall (N = 74)	
	N	%
Gender		
Female	61	82.4
Male	13	17.6
Age		
18-21	45	60.8
22-25	12	16.2
26-29	7	9.5
30 or above	10	13.5
Race		
Asian or Pacific Islander	3	4.1
Black or African American	5	6.8
Hispanic or Latinx	52	70.3
Mixed race	1	1.4
White or European	13	17.6
Academic standing		
First Year	17	23.0
Second Year	11	14.9
Third Year	29	39.2
Fourth Year	9	12.2
Fifth Year or more	8	10.8

Research Question 1

What is the current knowledge and understanding that college students have regarding E-cigarettes?

R.Q. 1: Knowledge Assessment	Yes N (%)	No N (%)	Not Sure N (%)
Do you know that E-cigarettes contain different chemicals and other substances that could be harmful to one's health?	69 (93.2%)	4 (5.4%)	1 (1.4%)
Do you know that E-cigarettes use can lead to long-term nicotine addiction?	65 (87.8%)	5 (6.8%)	4 (5.4%)

Table 2: An Assessment of Knowledge regarding harmful chemicals found inside E-cigarettes.

After assessing participants' knowledge of the harmful substances and effects of E-cigarettes on health, the results show that the majority of students surveyed had some knowledge that E-cigarettes could be damaging to their health (see Table 2). Specifically, when asked if they knew that E-cigarettes contained chemicals and substances that could be harmful to their health, 93.2% indicated "yes" while 5.4% indicated "no". Additionally, when asked if they knew that E-cigarettes could lead to long-term nicotine addiction, 87.8% indicated "yes" while 6.8% indicated "no".

Further results revealed that the majority of participants (93.2%) considered the use of E-cigarettes, as well as breathing in their vapor, to be somewhat or very harmful.

How harmful do you think breathing in E-cigarettes' vapor is? and How harmful do you think using E-cigarettes is?

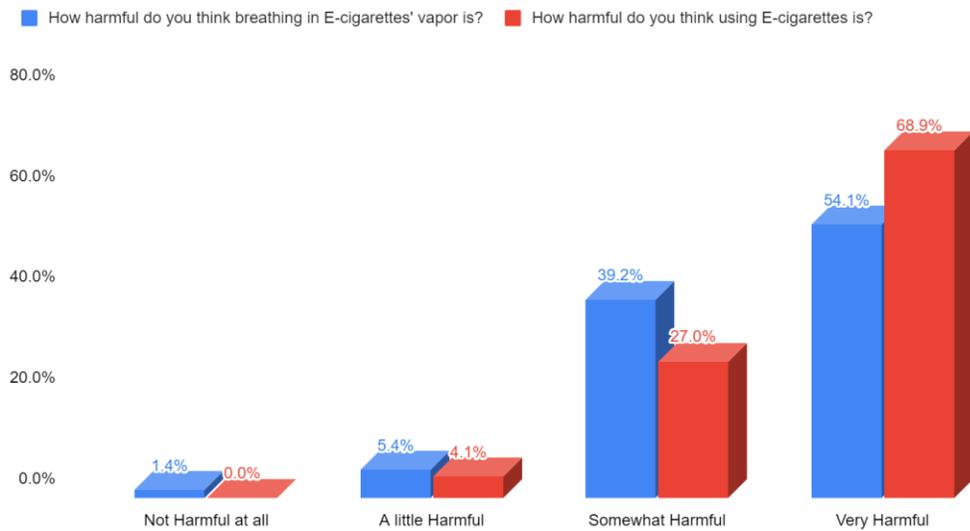


Figure 1: An assessment of Knowledge and the Harms of using E-cigarettes using a Likert scale.

When asked how harmful participants believed using E-cigarettes was, 68.9% considered them to be very harmful and 4.1% considered them little harmful. Further, when asked how harmful participants think breathing in E-

cigarette's vapor is, 54.1% thought it is very harmful and 1.4% found it to be not harmful at all.

Research Question 2

Among college students, is there a relationship between E-cigarettes use and one's academic standing level?

A Crosstabulation table was created to address whether E-cigarette use was related to respondents' academic standing.

Academic Level* Use Crosstabulation	Yes	No	Total
	N (%)	N (%)	N (%)
First	3 (15.0%)	14 (25.9%)	17 (24.0%)
Second	3 (15.0%)	8 (14.8%)	11 (14.9%)
Third	11 (55.0%)	18 (33.3%)	29 (39.2%)
Fourth	2 (10.0%)	7 (13.0%)	9 (12.2%)
Fifth	1 (5.0%)	7 (13.0%)	8 (10.8%)
Total	20 (100.0%)	54 (100.0%)	74 (100.0%)

Table 3: The relationship between E-cigarette use and respondents' Academic Standing Levels.

Findings suggests that, when assessing for consumption, there are more E-cigarette users among third-year students (55.0%) and the least number of users was among fourth (10.0%) year and fifth (5.0%) year students. In total, 73.0% of the participants reported not using E-cigarettes across all academic standing levels.

Research Question 3

What is the current attitude towards E-cigarettes among college students?

When asked about their attitudes towards E-cigarettes, participants seemed to have differing opinions regarding the potential health effects of these products.

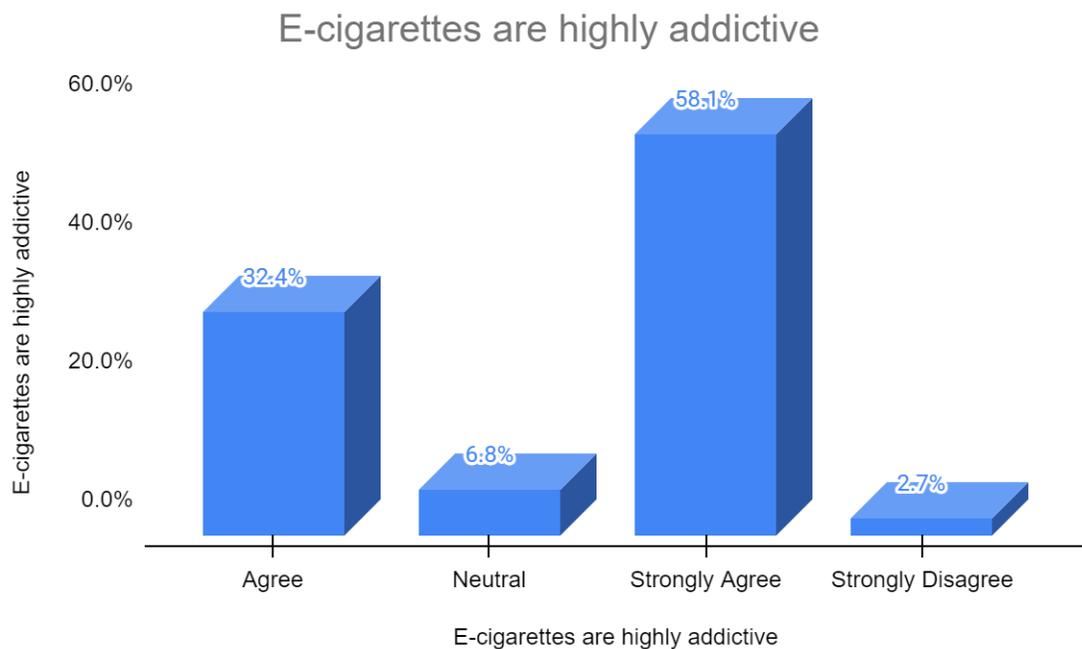


Figure 2: An assessment of Attitude towards the addictiveness of E-cigarettes using a Likert Scale

To assess for attitude, when asked whether “E-cigarettes are highly addictive,” 58.1% strongly agreed that these products are highly addictive and 2.7% strongly disagreed that E-cigarettes are highly addictive.

Comparatively, there was a significantly higher percentage of participants (33.8%) who were either unsure or agreed that they considered E-cigarettes to be safe when compared to regular cigarettes.

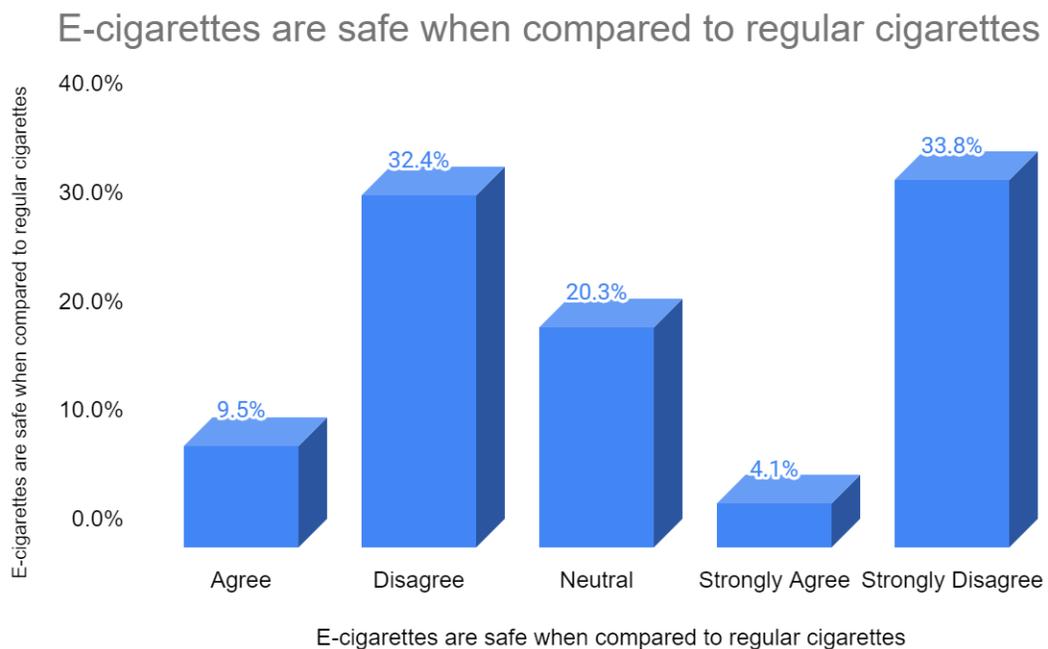


Figure 3: An assessment of Attitude towards E-cigarettes compared to regular cigarettes using a likert scale.

When assessing for their opinion on the comparative safety of E-cigarettes to regular cigarettes, 33.8% of participants strongly disagreed that E-cigarettes are safe compared to regular cigarettes, 9.5% agreed that E-cigarettes are safe, and 4.1% of participants strongly agreed that E-cigarettes are safe when compared to traditional cigarettes.

Research Question 4

What is the impact that the COVID-19 pandemic has had on the practices of E-cigarette usage among college students?

Variable	Overall (N = 74)	
	N	%
Have you ever used an E-cigarette?		
Yes	20	27.0
No	54	73.0
In a typical Month, how often do you use E-cigarettes?		
A few times a week	1	1.4
Daily	4	5.4
No usage at all	65	87.8
Once a month	2	2.70
Once a week	1	1.4
Twice a month	1	1.4
What are the reasons that you have used E-cigarettes?		
I am interested in the flavors	4	5.4
I don't use E-cigarettes	54	73.0
I was curious about them	13	17.6
They are less harmful than other forms of tobacco	1	1.4
Other	2	2.7

Table 4: E-cigarettes Practices among study participants.

The total amount of any E-cigarette users among the participants was 27.0%. Among users, 1.4% of them typically used E-cigarettes once a week, 1.4% of the participants used E-cigarettes a few times per week, and 5.4% of participants used E-cigarettes daily. Further, when assessing for the rationale

behind their consumption, participants stated that curiosity (17.6%) and an interest in the flavors (5.4%) were the most popular reasons for using these products.

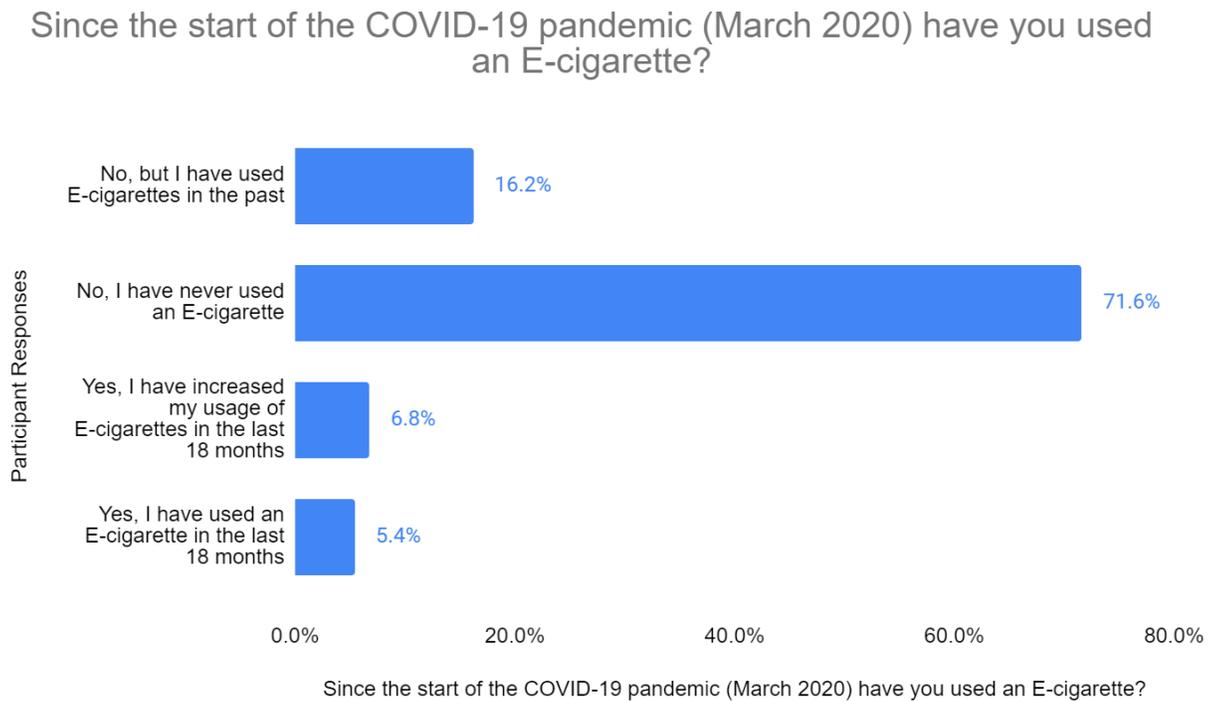


Figure 4: Assessing E-cigarettes Practices (use) during COVID-19 pandemic.

After analyzing the practices of E-cigarette use during the last 18 months of COVID-19 pandemic, 5.4% of the respondents either began, or continued using E-cigarettes during the last 18 months. Moreover, 6.8% of survey

respondents stated that they had increased their usage of E-cigarettes during the COVID-19 pandemic.

CHAPTER FIVE

DISCUSSION

This study focused on analyzing the Knowledge, Attitude, and Practices of college students regarding E-cigarettes. The majority of study participants were in their third year, predominantly female, Latinx/Hispanic, and between the ages of 18-21. Based on these results, there appears to be a need for more evidence-based education regarding E-cigarettes among college students at a public university in Southern California.

The findings from **Research Question 1** revealed that the majority of the participants are knowledgeable about some of the harmful effects of E-cigarettes on their overall health. However, there is still a need for evidence-based education among this population as 6.8% of the participants were not aware that the nicotine found in E-cigarettes can be highly addictive, and another 5.4% of the participants were unsure of this. This is consistent with a study conducted by Canzan et al. (2019) which revealed that students who were not exposed to information about E-cigarettes were more likely to consume these products due to a lack of knowledge of their chemical makeup.

Furthermore, 27.0% and 4.1% of participants considered E-cigarettes to be either somewhat harmful or a little harmful, respectively. These findings are consistent with Wang et al. (2020) who found 78.3% of college students were

unsure of the harmful chemicals and health effects of E-cigarettes. Additionally, 5.4% of participants identified E-cigarette vapor to be a little harmful, and 1.4% not harmful at all. This finding is further reinforced by Wang et al. (2020) who found that 65.2% of his study participants were either unsure or did not think that E-cigarettes produced harmful secondhand smoke.

Research Question 2 examined the relationship between participant's academic standing level and their usage of E-cigarettes. It was revealed that third year students were most likely to use E-cigarettes in comparison to those at other academic standing levels. Out of the 20 respondents who answered yes to using E-cigarettes, 55.0% of them stated that they were currently in their third year of study followed by 15.0% in their first- and second-year students. These findings differ from those previously reported, namely, Saddleson et al. (2015) who found that younger populations are significantly more likely to use E-cigarettes when compared to older populations. This further demonstrates a need for evidence-based education or intervention amongst this population with the goal of not only informing but also discourage consumption of E-cigarettes.

Research Question 3 assessed participants' attitudes toward E-cigarettes and the potential health effects of these products. When asked if they thought that E-cigarettes were highly addictive, 9.5% were either neutral or did not consider these products to be highly addictive. This suggests that further education is needed on the health effects of this product as an uncaring attitude towards these products can make people more likely to use them. For example,

Aqeeli et al. (2020) found that those that scored the lowest in an E-cigarette knowledge assessment on the addictiveness of these products were more likely to use them.

Furthermore, these results revealed that 33.8% of the participants stated they strongly agreed, agreed, or were neutral to the statement that E-cigarettes are safe when compared to regular cigarettes. These results are similar to Alzahrani et al. (2021) who found that 35.9% of their participants agreed that E-cigarettes are a safe alternative to traditional tobacco products. Therefore, changing this populations' attitudes towards E-cigarettes will require the use of evidence-based education strategies and interventions in order to discourage its consumption.

Research Question 4 showed that a small sample of the population either began using E-cigarettes or increased their usage during the COVID-19 pandemic. A total of 27.0% of participants claimed to have used E-cigarettes at least once in their lifetime. From this sample, 5.4% of all the participants had used an E-cigarette in the past 18 months, and 6.8% of the participants reported increasing their usage of E-cigarettes in the last 18 months (amid the COVID-19 pandemic). This coincides with a study by Gallus et al. (2020) who found, during the strictest phase of the COVID-19 lockdown (April – May 2020), E-cigarette use increased from 8.1% to 9.1% among Italian adults (Gallus et. al 2022).

Additionally, adolescent, and young adult E-cigarette users, between the ages of 13 – 24, were up to five times more likely to be diagnosed with COVID-

19 when compared to non-smokers (Gaiha, 2020). Gaiha, also mentions that the amount of chemicals and nicotine within E-cigarettes can damage the lungs potentially increasing the severity of a positive COVID-19 infection. Furthermore, Gaiha also mentions that one of the primary ways COVID-19 can spread is through the touching of hands and mouth to face, which is a motion that is frequently observed among E-cigarette users.

Strengths and Limitations

This study was not without limitations. The number of respondents were limited, and smaller sample sizes can have higher variability which may affect the reliability of the data. Additionally, respondents were mostly health science majors whose opinions and personal experiences may not be generalizable to the larger university population. The results of the study such as academic standing level and usage rates of E-cigarettes, may have been skewed. The validity of the result might have been affected due to not accurately measuring how students felt about E-cigarettes, since 3rd year students made up the majority of the E-cigarette users, as well as the majority of survey respondents. The time frame for data collection was also relatively short, lasting a total of 6 weeks which could have ideally been extended longer to help ensure the collection of a larger sample size. Finally, due to a smaller sample size, this study utilized descriptive statistics when formulating results versus inferential

statistics which allows for hypothesis testing or to assess whether the data is generalizable to the broader population

Despite these limitations, this study also had several strengths. First, this study utilized an evidence-based tool, the KAP model, when designing the survey questions. Additionally, the topics of E-cigarette use, and the current COVID-19 pandemic are highly relevant to public health given the pandemic's resilience and significant increases in E-cigarette users in the last several years (CDC, 2021b). After distributing the survey, a follow-up PowerPoint presentation containing evidence-based education on E-cigarettes was provided to all participants to allow them to enhance their knowledge on this subject. Additionally, the collection of primary data likely increased the reliability and validity of the study results.

Recommendations for Research and Practice

It would be worthwhile for future research to achieve a larger sample as this may yield more valid and reliable results. This study focused on a subsection of students who were mostly health science majors. Data collection across other majors may increase the generalizability of the results. Additionally, the use of a validated questionnaire would allow for more reliable data for each research question to be selected. I would also recommend implementing a follow-up survey, after the evidence-based education has been provided to study

participants to show the effectiveness of these methods in improving knowledge, attitude, and practice across this population.

This study also showed the need for evidenced-based education that will help close the gap in knowledge and attitudes towards E-cigarettes among this population. Over 90% of the participants had identified E-cigarettes as being harmful to their body and highly addictive, yet 33.8% still considered these products to be relatively safe to use in comparison to traditional cigarettes. This aligns with current literature which has shown that E-cigarettes have been perceived as a less risky alternative, and college students felt they were more likely to use this product (Noland et al., 2016). Evidenced-based education has been used by multiple sources such as the American Lung association, the FDA, and the Centers for Disease Control, and found to be an effective method for reducing and preventing youth smokers from using E-cigarettes. There are several programs and resources provided by these sources that can provide such education such as: the American Lung Association's Not on Tobacco (NOT) smoking cessation program, The Real Cost Campaign created by the Food and Drug Administration, or Tobacco Free California. Each of these programs has various resources that can be used to help people either quit using E-cigarettes or prevent them from using it.

Conclusion

The purpose of this study was to examine the Knowledge, Attitudes, and Practices of College students at a public university in Southern California, regarding E-cigarette use, and how the COVID-19 pandemic may have influenced use. There is currently a gap in knowledge among participants regarding the harmful effects of E-cigarettes that is further supported by findings from other similar which have found that many of their respondents also lacked knowledge about E-cigarettes. Many participants were also unsure of how addictive E-cigarettes could be, and many considered these products to be safe when compared to traditional cigarettes. Additionally, this study found that the majority of E-cigarette users were in their 3rd year or earlier which demonstrates that younger ages are more likely to use E-cigarettes. This has been validated in the literature whereby studies have found that typically, E-cigarettes are used by a younger audience. Finally, this study also explored the possible relationship between E-cigarette use during the COVID-19 pandemic given that participants increased or began using E-cigarettes during the pandemic. Further research should consider incorporating evidenced-based E-cigarette education among college students in order to discourage them from using such products.

APPENDIX A
INSTITUTIONAL REVIEW BOARD APPROVAL FORM



November 2, 2021

CSUSB INSTITUTIONAL REVIEW BOARD

Expedited Review
IRB-FY2022-138
Status: Approved

Prof. Salome Mshigeni
CNS - Health Science

California State University, San Bernardino
[5500 University Parkway](#)
San Bernardino, California 92407

Dear Prof. Mshigeni:

Your application to use human subjects, titled "Assessing E-cigarette's Knowledge and Practices among college students amid COVID-19 pandemic" has been reviewed and approved by the Institutional Review Board (IRB) of CSU, San Bernardino. The CSUSB IRB has weighed the risk and benefits of the study to ensure the protection of human participants. The study is approved as of November 2, 2021. The study will require an annual administrative check-in (annual report) on the current status of the study on November 1, 2022. Please use the renewal form to complete the annual report.

This approval notice does not replace any departmental or additional campus approvals which may be required including access to CSUSB campus facilities and affiliate campuses. Investigators should consider the changing COVID-19 circumstances based on current CDC, California Department of Public Health, and campus guidance and submit appropriate protocol modifications to the IRB as needed. CSUSB campus and affiliate health screenings should be completed for all campus human research related activities. Human research activities conducted at off-campus sites should follow CDC, California Department of Public Health, and local guidance. See CSUSB's [COVID-19 Prevention Plan](#) for more information regarding campus requirements.

If your study is closed to enrollment, the data has been de-identified, and you're only analyzing the data - you may close the study by submitting the Closure Application Form through the Cayuse Human Ethics (IRB) system. The Cayuse system automatically reminds you at 90, 60, and 30 days before the study is due for renewal or submission of your annual report (administrative check-in). The modification, renewal, study closure, and unanticipated/adverse event forms are located in the Cayuse system with instructions provided on the IRB Applications, Forms, and Submission Webpage. Failure to notify the IRB of the following requirements may result in disciplinary action. Please note a lapse in your approval may result in your not being able to use the data collected during the lapse in the application's approval period.

You are required to notify the IRB of the following as mandated by the Office of Human Research Protections (OHRP) federal regulations 45 CFR 46 and CSUSB IRB policy.

- **Ensure your CITI Human Subjects Training is kept up-to-date and current throughout the study.**
- **Submit a protocol modification (change) if any changes (no matter how minor) are proposed in your study for review and approval by the IRB before being implemented in your study.**
- **Notify the IRB within 5 days of any unanticipated or adverse events are experienced by subjects during your research.**
- **Submit a study closure through the Cayuse IRB submission system once your study has ended.**

The CSUSB IRB has not evaluated your proposal for scientific merit, except to weigh the risks and benefits to the human participants in your IRB application. If you have any questions about the IRB's decision please contact Michael Gillespie, the IRB Compliance Officer. Mr. Michael Gillespie can be reached by phone at (909) 537-7588, by fax at (909) 537-7028, or by email at mgillesp@csusb.edu. Please include your application approval number IRB-FY2022-138 in all correspondence. Any complaints you receive regarding your research from participants or others should be directed to Mr. Gillespie.

Best of luck with your research.

Sincerely,

Nicole Dabbs

Nicole Dabbs, Ph.D., IRB Chair
CSUSB Institutional Review Board

ND/MG

APPENDIX B
SURVEY QUESTIONS

Demographics:

1. What is your age range?
 - a. 18-21
 - b. 22-25
 - c. 26-29
 - d. 30+
2. What best describes your race/ethnicity?
 - a. Whites/European American
 - b. Black or African American
 - c. Hispanic or Latino
 - d. Native American
 - e. Asian or Pacific Islander
 - f. Other
3. What is your Gender?
 - a. Male
 - b. Female
 - c. Other
4. What is your current academic standing level?
 - a. First Year
 - b. Second Year
 - c. Third Year
 - d. Fourth Year
 - e. Fifth or more
 - f. Graduate student
5. Do you know that E-cigarettes contain different chemicals and other substances that could be harmful to one's health?
 - a. Yes
 - b. No
 - c. Not sure

Knowledge:

1. How harmful do you think using E-cigarettes is?
 - a. Not Harmful at all
 - b. A little harmful
 - c. Somewhat Harmful
 - d. Very Harmful
2. How harmful do you think breathing in E-cigarette's vapor is?
 - a. Not Harmful at all
 - b. A little harmful
 - c. Somewhat Harmful
 - d. Very Harmful
3. Do you know that E-cigarettes use can lead to long-term nicotine addiction?
 - a. Yes
 - b. No
 - c. Not Sure

Attitude:

1. E-cigarettes are safe when compared to regular cigarettes.
 - a. Strongly Agree
 - b. Agree
 - c. Neutral
 - d. Disagree
 - e. Strongly Disagree
2. E-cigarettes are highly addictive
 - a. Strongly Agree
 - b. Agree

- c. Neutral
- d. Disagree
- e. Strongly Disagree

Practice:

1. Have you ever used an E-cigarette?
 - a. Yes
 - b. No
2. In a typical Month, how often do you use E-cigarettes?
 - a. Daily
 - b. A few times a week
 - c. Once a week
 - d. Twice a month
 - e. Once a month
 - f. No usage at all
3. Since the start of the COVID-19 pandemic (March 2020) have you used an E-cigarette?
 - a. Yes, I have increased my usage of E-cigarettes in the last 18 months
 - b. Yes, I have used an E-cigarette in the last 18 months
 - c. No, I have never used an E-cigarette
 - d. No, but I have used E-cigarettes in the past
4. What are the reasons that you have used E-cigarettes?
 - a. They are less harmful than other forms of tobacco
 - b. I was curious about them
 - c. I am interested in the flavors
 - d. Other
 - e. I don't use E-cigarettes

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