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ASSESSING KNOWLEDGE, ATTITUDE, AND PRACTICE AMONG COLLEGE STUDENTS REGARDING SECOND-HAND AND THIRD-HAND SMOKE

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A Thesis

Presented to the

Faculty of

California State University,

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In Partial Fulfillment

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Master of

Public Health

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by

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ABSTRACT

Background: The tobacco epidemic has been a constant since the popularization of tobacco products. However, with the introduction of non-combustible products that include e-cigarettes and vapes, the usage of tobacco products has continued to increase. Tobacco exposure can stem from first-hand (FHS), second-hand (SHS), and third-hand smoke (THS), with the last two impacting even non-smokers. The health effects from all types of tobacco exposure can be detrimental. These effects include the risk of cancer in any organ of the body, cardiovascular disease, and respiratory diseases.

Methods: The study utilized a cross-sectional design through an anonymous web-based survey given to students in a public college institution. Their knowledge, attitude, and practices regarding first-hand, second-hand, and third-hand smoke were assessed. The data collected was analyzed using SPSS version 28.

Results: A total of 197 survey responses regarding student knowledge, attitudes, and behaviors were collected and analyzed. Key results indicated most students believed SHS (78.2%) and THS (92.9%) smoke are not receiving enough attention. Students stated they believed the general population is somewhat informed (69.0%) regarding secondhand smoke, but about 58% agreed the general population is not at all informed about thirdhand smoke. The study also found 70.4% of surveyed students were highly likely/likely to discuss SHS and THS with their family, while 61.7% agreed they were highly likely/likely

to discuss the topics with their peers as well. However, 23% of students stated they were highly unlikely/unlikely to research more about SHS and almost 19% of students agreed they were highly unlikely/unlikely to research more about THS. Another key finding was assessment of student behavior regarding tobacco products. Only 4.6% of survey respondents confirmed they do currently use tobacco products, while the majority (95.4%) stated they do not.

Conclusion: The results of the study showed a clear knowledge gap regarding the different tobacco exposures, specifically THS. The study suggested students believed this gap in knowledge was prevalent with other individuals in their social environment, including family and friends. Despite this, most students were willing to discuss potentially sensitive topics with their social circles. A call to action for college institutions to close the gap of knowledge on second-hand and third-hand smoke to educate students on the harmful effects of tobacco use is recommended. This study suggests if students obtain education on these topics and feel confident in their knowledge, conversation and advocacy onto their social environments may be encouraged.

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CHAPTER ONE:

INTRODUCTION

Overview

Tobacco use is the leading cause for many preventable diseases in the United States. Although popularity for traditional smoking has decreased in the past century, there is still a significant portion of the population that engages in tobacco use. In addition, substantial amounts of the population that do not partake in direct tobacco use are still suffering detrimental health effects due to secondhand and thirdhand smoke. With the increase of various tobacco products that are advertised to all types of consumers, including youth, the tobacco epidemic has once again become a significant issue that requires immediate research and action. The various tobacco products on the current market are outlined in this research paper, along with the serious health effects that are linked to tobacco.

What is Tobacco?

Tobacco in products refers to the tobacco leaves from the plant that are dried and fermented to be used in the products. Tobacco contains many harmful ingredients, including nicotine which is the main chemical that contributes to addiction. When consuming a tobacco product, the nicotine in the product is absorbed into the bloodstream, leading to stimulation of the adrenal glands. A rush of adrenaline then occurs, and an increase of dopamine is experienced by

the user, creating a “rewarding behavior” that contributes to addiction (NIDA, 2021).

In addition, tobacco contains other harmful chemicals that can be natural or chemically added during the manufacturing process, including carcinogens which are cancer-causing agents (FDA, 2022). Other harmful chemicals include tobacco-specific nitrosamines (TSNAs), lead, and cadmium. Chemicals found in tobacco products vary on the type of product and may form once the product is burned or heated (FDA, 2022).

Types of Tobacco Exposure

Exposure to tobacco smoke and chemicals does not derive from an individual source, nor does it solely impact the individuals actively consuming the tobacco product. First-hand smoke (FHS) is the smoke or vapor inhaled by the person actively smoking, vaping, or directly using a tobacco product. This exposure is often referred to as mainstream smoke. The combination of this smoke or vapor, and the smoke being exhaled from the active user comprises second-hand smoke (SHS), also known as environmental tobacco smoke (ETS), side-stream smoke, or passive smoking. These two types of exposures have been topics of discussion for several decades and despite efforts to decrease exposure through smoke-free laws, tobacco is still one of the leading causes of death and serious disease in the United States (CDC, 2022).

A great contributor to the health effects of tobacco exposure is third-hand smoke (THS). THS refers to the chemical residue on objects such as furniture, walls, clothing, and any surface exposed to SHS that continues to linger for an extended amount of time after the smoke has emptied from the area (ThirdHand Smoke Resource Center, 2022). THS can be transferred through touch, ingestion, and inhalation when an individual encounters a contaminated surface or location. It can linger on surfaces for years and is difficult to properly remove since it can deeply penetrate porous materials. According to Sleiman et al. (2010), findings from a study showed that residue absorbed from tobacco smoke on surfaces underwent a chemical reaction with other indoor chemicals already present in homes that formed carcinogenic elements. This leftover residue was dubbed thirdhand smoke.

Types of Tobacco Products

Tobacco products are divided into two categories: combustible and non-combustible products.

Combustible products require burning to process the tobacco leaves in the product for consumption. Examples of these products include cigarettes, cigars, blunts, and hookahs. On the other hand, non-combustible products encompass several types of products that do not require any type of burning for consumption.

A type of non-combustible product is smokeless tobacco products. Smokeless tobacco products do not require combustion, do not create smoke,

and do not require inhalation for consumption. This type of tobacco product often involves placing the product between the gum, lip, or cheek of the consumer, and may require sucking, spitting, swallowing, or chewing. Examples of smokeless tobacco products are snuff and chewing tobacco. Regardless of the type of smokeless tobacco product, they all contain nicotine and are highly addictive (CDC, 2022). Exposure to the toxic chemicals in smokeless tobacco products contributes to thirdhand smoke as well.

Heated tobacco products are often referred to as “heat-not burn” products. They use heat versus combustion to process tobacco leaves and create an aerosol that contains nicotine then inhaled by the user (CDC, 2022). Similarly, Electronic Nicotine Delivery System (ENDS) products heat a liquid that contains nicotine derived from tobacco to create an aerosol that is inhaled by the user (FDA 2022). Popular heated tobacco products are vaping devices, Juuls, tanks, mods, e-cigarettes, and tobacco “pens”.

Health Effects of Tobacco Exposure

Tobacco exposure from first-hand, second-hand, and third-hand smoke have serious health effects that impact direct consumers and non-smokers exposed to the product. The Centers for Disease Control and Prevention (CDC), as well as the American Cancer Society, have exclusively labeled smoking as the leading preventable death in the United States (Siegel et al. 2021). The CDC

estimates that smoking cigarettes leads to 480,000 deaths every year, while SHS accounts for an estimated 41,000 deaths a year (2022).

Cancer and Tobacco Exposure.

Cancer is the most well-known health effect caused by FHS, SHS, and THS due to the carcinogenic chemicals that weaken the immune system and allow cancer cells to reproduce uncontrollably. Specifically, FHS has been linked to cancer throughout the entire body from the usage of combustible and non-combustible products. Cancers in the oropharyngeal (middle throat), stomach, bladder, liver, kidney, lung, and in other major parts of the body have been tied to tobacco products (Andreotti et al. 2017). Lung cancer has been the most prevalent type of cancer caused by FHS with 82% of all lung cancer deaths directly caused by cigarette smoking in 2021.

In a study conducted among an agricultural population, cigarette smokers had an increased risk of cancer compared to never smokers. Increased risk for lung cancer was the highest, followed by head and neck, then by urinary cancers, and lastly gastrointestinal cancers (Andreotti et al. 2017). The type of cancers found in the research population can be observed in Table 1.

Table 1. Types of Cancer Observed in Research Population

Head and Neck Cancers	Gastrointestinal	Urinary Cancers
Oral Cavity Cancers	Colon	Bladder
Nasal Cavity	Rectum	Kidney

Oropharyngeal (Middle Throat)	Pancreas	
	Stomach	
	Esophagus	

Lung cancer caused by tobacco exposure is a concern for nonsmokers too due to SHS exposure. SHS increases the risk of cancer through exposure to carcinogens that affect tumor genes and create uncontrollable cell growth (Kim et al. 2018). The CDC estimated SHS is the cause for 7,300 lung cancer deaths annually in individuals who do not smoke (Smoking and Tobacco Use, CDC 2022).

Cardiovascular Disease and Tobacco Exposure

Cardiovascular disease (CVD) impacts the heart and blood vessels through heart diseases and strokes. The CDC contributes FHS to CVD due to the chemicals found in the smoke. These chemicals cause blood cell thinning, plaque buildup in blood vessels, blood clotting, and distortion of blood vessels which all increase the likelihood of cardiovascular disease (2022). The most common CVD can be observed in Table 2.

Table 2. Most Common Cardiovascular Disease in Smokers

Cardiovascular Disease	

Atherosclerosis	Occurs when there is build-up of plaque and a narrowing of blood vessels leading to limited blood flow. Smoking increases the build-up of plaque in blood vessels.
Coronary Heart Disease (CHD)	Occurs when plaque or blood clots block the arteries that carry the blood to the heart. Chemicals in tobacco smoke thicken the blood and increase the risk for blood clots.
Stroke	Loss of brain function due to interrupted blood flow to the brain. Smoking increases the risk for strokes.
Peripheral Arterial Disease (PAD)	Occurs when blood flow to the arms and legs decrease due to narrowed blood vessels. Smoke increases the risk of PAD.

In a meta-analysis where the relationship between stroke and cigarette smoking was researched, it was found that current smokers have a significantly increased risk of stroke when compared to non-smokers, as well as an increased risk for sudden cardiac death. The risk of stroke was increased by 12% for every increment of 5 cigarettes per day (Pan et al. 2019).

Individuals exposed to SHS are burdened with serious cardiovascular disease as well and increase their risk of CVD by 25-30%, regardless of the duration of exposure time (CDC, 2022).

Chronic Obstructive Pulmonary Disease (COPD)

According to the CDC, COPD is defined as a group of diseases that cause airflow blockage and breathing-related problems usually caused by smoking cigarettes (Smoking and COPD, 2022). Approximately 80% of COPD deaths in the United States are linked to smoking and is one of the leading global causes of deaths for many cigarette smokers (Chang et al. 2021). A study using a COPD risk prediction model was conducted to analyze the relationship between COPD development and smoking patterns. The study concluded COPD prevalence is 30% times higher in smokers versus former smokers. The risk of getting diagnosed with COPD is higher as well for a continued smoker versus a former smoker. The risk of COPD increased depending on smoking status, intensity, and older age, but results clearly showed the impact of active smoking status (Chang et al. 2021).

Long-term exposure to SHS is linked to COPD as well due to exposure to irritants, despite having non-smoker status with approximately 1 out of 4 Americans diagnosed with COPD having never smoked cigarettes (CDC, 2022). The period of SHS exposure, whether during childhood or teenage years, is linked to slower lung growth and development, increasing the risk of COPD during adulthood.

In a study by Korsbaek and colleagues (2021), individuals exposed to SHS during different periods of their life were observed. 20,421 participants were

studied and analyzed, taking note of their respiratory symptoms and period of SHS exposure. Table 3 demonstrates the health effects prevalent dependent on exposure period.

Table 3. Health Effects During Different Exposure Times

Exposure During Childhood	Exposure During Adulthood
Increased risk of wheezing and asthma	Reduced lung function
Reduced lung function	Increased risk of COPD
Increased risk of wheezing and cough as adults	Increased risk of wheezing
	Increased risk of dyspnea (labored breathing)
	Increased risk of respiratory symptoms such as coughing and breathlessness

Asthma

Asthma is a respiratory disease that affects the lungs and can include symptoms like wheezing, coughing, and labored breathing. FHS can trigger asthma attacks for individuals who continue to smoke and have the disease. SHS can worsen asthma and plays a vital role in asthma development. Maternal smoking in specific has shown to increase wheezing in infants while reducing overall lung function. In a study conducted among asthma patients, progressive exposure to SHS was seen to aggravate damage to the respiratory system,

worsen asthma symptoms such as increased bronchial secretion, reduced lung function, poorer response to drug therapy, and overall poor disease control (Lima et al. 2020). During a study focusing on asthmatic participants and SHS exposure, the symptoms observed are outlined in Table 4 (Merianos et al. 2019).

Table 4. Asthmatic Symptoms Observed

Asthmatic Participant Actively Living with a Smoker	Asthmatic Participant Exposed to SHS
Shortness of Breath	Wheezing Disturbance During Sleep
Harder to do Exercise	Dry Cough at Night
Wheezing in the Chest	Asthma Symptoms During Sleep
Wheezing Limited Speech	
Wheezing During or After Exercise	
Higher number of asthma attacks that required steroid medication than participants not living with a smoker	

Maternal/Child Health and Tobacco Exposure

FHS exposure during pregnancy can have serious health effects on the mother and to the fetus during development. Mothers who smoke during pregnancy put their children at risk for Sudden Infant Death Syndrome (SIDS), poor lung development, low weight, and overall poor respiratory function (Office on Smoking and Health (US), 2006). Smoking during pregnancy results in more

than 1,000 annual infant deaths in the United States and can increase the risk for preterm births, miscarriages, and abnormal bleeding (CDC, 2022). Furthermore, low birth weight, premature birth, birth defects such as cleft lips, and low developed brains and lungs are often observed in infants with mothers who smoked during pregnancy (CDC, 2022).

During a study conducted on 800 pregnant women during the pregnancy and postpartum period, tobacco consumption during conception and pregnancy was associated with an increased risk of placental disease, spontaneous miscarriage, and premature births (Miguez, 2021). Furthermore, infants breastfed by smoking mothers were exposed to nicotine through breast milk, which increased risk for diarrhea and nausea. Lower birth weight was also observed with babies that were born to smoking mothers. The infants from smoking mothers weighed 150 to 250 g less than babies born to non-smoking mothers. Tobacco consumption was associated with more complications during delivery and lower prevalence of breastfeeding. Overall, mothers who did not smoke and lived in smoke-free homes had fewer pregnancy complications and less health effects with their babies (Miguez, 2021). Table 5 outlines the health effects observed in the study caused by tobacco consumption.

Table 5. Health Effects Caused by Tobacco Consumption in Mothers

Non-Smoking Mothers	Continuous Abstinent Mothers	Passive Smoking Mothers	Active Smoking Mothers

Greater birth weights than active and passive smoking mothers	Fewer pregnancy and delivery complications	More likely to have complications during pregnancy and delivery	More likely to have complications during pregnancy and delivery
	Greater birth weights than passive smoking mothers	Less likely to breastfeed	Less likely to breastfeed
			Deliver babies with health problems

Children exposed to SHS outside of the womb are vulnerable to health effects and developmental issues. According to the CDC, children who are exposed to SHS by family members who smoke can have serious health problems. The most common health problems linked to SHS in children are respiratory symptoms, severe asthma attacks, impaired lung function due to poor development, middle ear disease, lower respiratory illness, and SIDS (CDC, 2022). In a study conducted to observe the influence of SHS on children, it was found that various parts of the body were gravely harmed (Braun et al. 2020). Exposure to SHS had negative effects on the vascular walls in early life, increasing the risks for CVD, cancer, and worsening allergies and asthma triggers in children.

Diabetes and Tobacco Exposure

Diabetes is a long-term disease that impacts how glucose is converted into energy in the body. Smoking directly affects type 2 diabetes, which is linked

to lifestyle behaviors, due to the insulin resistance it creates. According to the CDC, people who smoke cigarettes are 30%–40% more likely to develop type 2 diabetes than people who do not smoke (Smoking and Diabetes, 2022). In a meta-analysis of 343, 573 subjects and 16,383 patients with type 2 diabetes in Japan, studies confirmed several findings regarding smoking and diabetes in the test subjects (Akter et al. 2017). The increased risk of type 2 diabetes for current smokers was 38% higher versus non-smokers and risk for type 2 diabetes was consistent during the first five years of smoking cessation. In addition, a dose-response relationship between risk and the number of cigarettes smoked per day was observed as the risk of type 2 diabetes increased by 16% for each increment of 10 cigarettes smoked a day.

Third-Hand Smoke Health Effects

Although research is recent for THS, studies on live animals have been conducted to better understand the potential health effects on humans. In a study conducted on mice, THS was shown to have a deteriorating impact on organs, wound healing, lung and liver damage. These effects are predicted to occur in humans too, with children especially vulnerable to THS (Peyton et al. 2016). According to the Tobacco Related Disease Research Program (TRDRP), infants in smoking households are exposed to nicotine through THS (2023). In research concentrating on THS levels on types of clothing fabric, nicotine exposure from THS was “6.8 times higher in children and 24 times higher in adults' ' than what would be inhaled by SHS (TRDRP, 2023).

In another study conducted, mice were exposed to THS for three weeks from the 4-7 weeks of age until they reached 47 weeks of age. A significant increase in lung adenocarcinoma, cancer that lines the glands of the organs, was observed in the mice exposed to THS versus the control group (Hang et al. 2019). According to the TRDRP-funded research on THS, it has been linked to increased health risks due to exposure to carcinogens and other toxic chemicals left by tobacco smoke that damage DNA and other genetic material, increasing the risk of cancer in general (2023).

Summary

Cumulatively, the current literature explains how FHS, SHS, and THS pose great health risks to individuals regardless of smoking status and regardless of the type of tobacco device being used, whether it be combustible or noncombustible. FHS and SHS put individuals at elevated risk for cardiovascular disease and several types of cancer throughout the entire body. They can worsen symptoms for respiratory illnesses and diabetes. FHS and SHS can have lethal health effects to children and fetuses during pregnancy, while also affecting maternal health. THS, although a developing research study, has shown to increase the risk of cell mutation and DNA damage, increasing the risk of cancer.

CHAPTER TWO:

METHODS

Study Design

This study used a cross-sectional study design to assess the knowledge, attitudes and practices regarding FHS, SHS, and THS among college students.

Data Collection

Data was collected using a cross-sectional web-survey based method from students attending a four-year university with tobacco-free policies implemented on campus. Tobacco priority population was represented in the data collection as the campus is a federally designated Hispanic and minority serving university. The population surveyed allowed representation of minority populations such as majority-female student population, Hispanic, first generation, and from low-income status, comprising a tobacco priority population.

Multiple instructors on campus from various programs on campus were sent an email to distribute the survey to their classes, with the possibility of extra credit as an incentive for students to complete the survey. Courses taken by more than one major were prioritized to ensure diversity of disciplines on campus and avoid over-sampling of one specific study. Informed consent was given to students and full access to the survey was only available to students who volunteered to participate in the study. All surveys were given electronically, and all answers were collected electronically as well. No identifiable information was collected from the participants, ensuring anonymity guidelines were adhered to.

Measures and Data Analysis

Basic demographic information was collected from the participants through the following questions:

- What racial and ethnic group do you identify with?
- What is your age group (in years)?

The participants' attitude towards the attention SHS and THS was receiving was assessed by the following questions:

- How much attention do you think second-hand smoke is getting?
- How much attention do you think third-hand smoke is getting?

Next, the participants' attitudes towards the knowledge of different communities in their personal lives on SHS and THS were measured with the following questions:

- How informed do you feel the general population is regarding second-hand smoke?
- How informed do you feel the general population is regarding third-hand smoke?
- How informed do you feel your family members are regarding second-hand smoke?
- How informed do you feel your family members are regarding third-hand smoke?

- How informed do you feel your fellow college students are regarding second-hand smoke?
- How informed do you feel your fellow college students are regarding third-hand smoke?
- How informed do you feel your friends are regarding second-hand smoke?
- How informed do you feel your friends are regarding third-hand smoke?
- How informed do you feel your community/where you live are regarding second-hand smoke?
- How informed do you feel your community/where you live are regarding third-hand smoke?

The student's intention toward sharing information regarding SHS and THS were assessed with the following questions:

- How likely are you to discuss the issue of secondhand smoke or thirdhand smoke with your family?
- How likely are you to discuss the issue of secondhand smoke or thirdhand smoke with your peers?
- How likely are you to discuss the issue of secondhand smoke or thirdhand smoke with a community organization?
- How likely are you to do more research on secondhand smoke?
- How likely are you to do more research on thirdhand smoke?

Lastly, the student's tobacco practices were assessed through the following question:

- Do you currently use any tobacco products?

Descriptive analysis was conducted using SPSS version 28.

Ethics

To ensure the study followed proper human research guidelines, the Belmont Report was implemented, adhering to the following three principles: respect for persons, beneficence, and justice. Respect for persons was ensured by allowing participants to volunteer to participate in the study, without any consequence if they decided not to take part in the study. Informed consent was delivered to all participants as well, providing them with sufficient information to make an adequate decision on their participation. The participants' right to privacy was respected through protection of all confidential information. The data was collected anonymously, and no identifiable information was collected. Beneficence was ensured by minimizing harm to the participants and maximizing benefits. Extra credit for participation was implemented to increase benefits. To reduce harm, students were not penalized for deciding not to participate in the study. Respect for their privacy reduced the risk to the participants by ensuring complete anonymity when answering sensitive questions. Lastly, all college-aged students (18 years of age or older) enrolled in the same university campus in Southern California could participate in the study. Various instructors from

different programs and departments distributed the survey to their classes as well. This ensured justice was adhered to by eliminating the burden to a group, while another group benefited. The study was approved by the Institutional Review Board (IRB-FY2022-196) of the institution. The graduate student participating in the conduction of the study completed the Collaborative Institutional Training Initiative (CITI) Program course: Human Research - Biomedical Research Investigators and Personnel: Stage 1 Basic Course (Record ID 45689254).

CHAPTER THREE:

RESULTS

This chapter explains the findings based on the surveys that were distributed to the study population. Students aged 18 and older who took the survey demonstrated a range of knowledge, attitude, and practice (KAP) towards tobacco use and its health effects. The survey questions were constructed to gain comprehension of college students' understanding of tobacco that went beyond first-hand smoke. In total, 197 anonymous surveys were collected and analyzed. Basic demographic questions were asked of the participants such as ethnicity and age.

Figure 1 outlines the racial/ethnic groups that were surveyed. Almost half of the participants identified as Hispanic/Latino (47.9%), about 26% identified as Asian, Pacific Islander/Hawaiian Native, while almost 10% identified as White (non-Hispanic), followed by about 5% who identified as African American/Black (non-Hispanic). The remaining racial groups that participated were made up of two or more groups (8.2%) and of "Other" (3.1%).

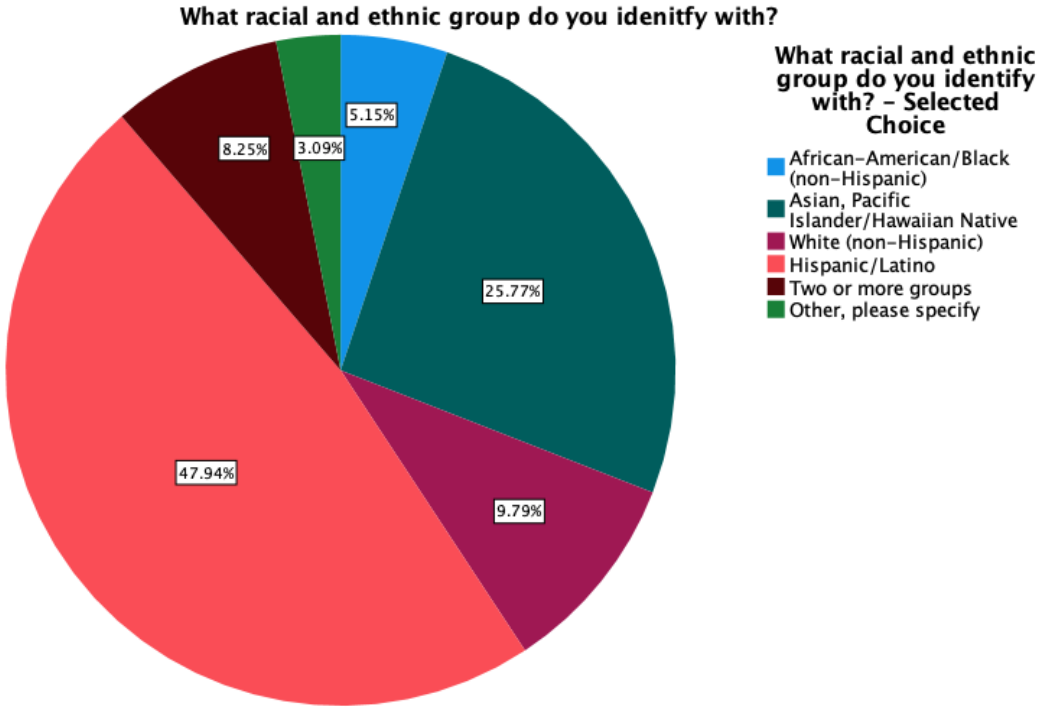

Figure 1. What Racial and Ethnic Group Do You Identify With?

The age group of the study population was assessed through the questions “What is your age group (in years)?”. There were no individuals under the age of 18 who took the survey. Most of the participants encompassed the age group 21-23 years of age (38.66%), followed by the age group 18-20 years of age (27.84%). Abou 17% of the respondents was between the ages of 24-26, with about 7% being between 27-29. The smallest percentage (9.28%) belonged to the age group 30 and above.

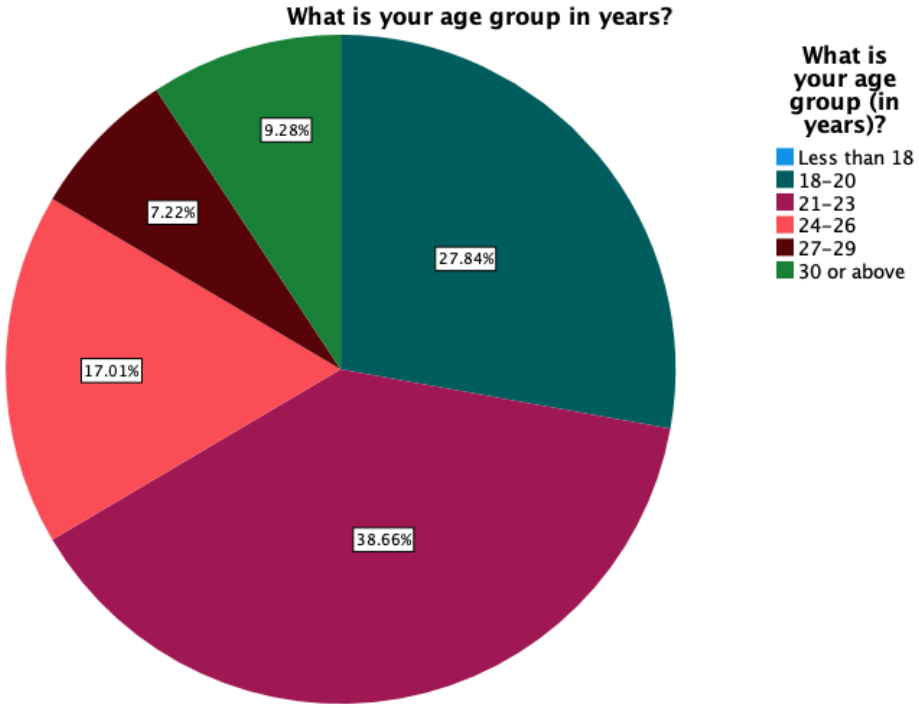

Figure 2. What is Your Age Group (in Years)?

Analysis

Table 6 provides the results of the survey questions: "*How much attention do you think second-hand smoke is getting?*" and "*How much attention do you think third-hand smoke is getting?*". When asked about second-hand smoke, around 78% of the respondents said not enough attention was given to the topic, followed by around 10% of students stating just the right amount. Almost 10% of survey respondents were not sure of their answer while only 2% of students stated too much attention was given to second-hand smoke. There was a clear polarity of students who believed second-hand smoke was not receiving enough attention versus students who believed the topic was receiving too much

attention. Table 6 breaks down the percentages to demonstrate the significant contrast.

Comparable results for third-hand smoke are displayed in Table 6 with almost 93% of survey participants stating not enough attention is given to third-hand smoke while about 1.5% stated just the right amount of attention is given. Only about 5% of students were not sure of the level of attention the topic was receiving and only 0.5% of students stated too much attention was being placed on third-hand smoke.

Table 6. How Much Attention Do You Think Second-hand Smoke/Third-hand Smoke is Getting?

	Second-hand smoke (SHS)	Third-hand smoke (THS)
Not enough	78.2%	92.9%
Just the right amount	10.2%	1.5%
Too much	2.0%	0.5%
Not sure	9.6%	5.1%

The next several questions that are outlined in the following tables give insight on the extent of knowledge of second-hand and third-hand smoke in specific populations. To begin with, students were asked "*How informed do you feel the general population is regarding second-hand smoke?*". Most participants noted that they believed there was some sort of level of knowledge within the general population. Specifically, 69.0% of students agreed the general population was somewhat informed regarding second-hand smoke, while almost 16% of

students disagreed, stating they believed the general population was not at all informed. Almost 9% of students believed the general population was very informed about second-hand smoke, however 6.6% were not sure on the level of knowledge.

Regarding third-hand smoke, the respondents were asked "H*ow informed do you feel the general population is regarding third-hand smoke?*". In contrast to second-hand smoke, about 58% of students believed the general public was not at all informed while about 26% of students indicated the general public was somewhat informed. Approximately 13% of survey respondents were not sure of their answer, with only 2% of students stating the general population is very informed regarding THS. Table 7 displays these results.

Table 7. How Informed Do You Think the General Population is Regarding Second-hand Smoke/Third-hand Smoke?

	Second-hand smoke (SHS)	Third-hand smoke (THS)
Not at all informed	15.7%	58.4%
Somewhat informed	69.0%	26.4%
Very informed	8.6%	2.0%
Not sure	6.6%	13.2%

Students were questioned regarding the level of knowledge they believed their family possessed, specifically "*How informed do you feel your family members are regarding second-hand smoke?*". Many respondents (48.7%) confirmed their family members were somewhat informed, followed by 36% of

students stating they were very informed on second-hand smoke. On the opposite spectrum, roughly 14% of students stated their family members were not informed at all, with only 1.5% of students not sure about the level of knowledge. When students were asked "*How informed do you feel your family members are regarding third-hand smoke?*", almost 60% of survey respondents stated they were not informed at all. About 30% of students stated they were somewhat informed on the topic, with only about 6% stating they were very informed. Almost 9% of students were not sure of their families' level of knowledge of third-hand smoke as outlined in Table 8.

Table 8. How Informed Do You Feel Your Family Members are Regarding Second-hand Smoke/Third-hand Smoke?

	Second-hand smoke (SHS)	Third-hand smoke (THS)
Not at all informed	13.7%	59.9%
Somewhat informed	48.7%	25.9%
Very informed	36.0%	5.6%
Not sure	1.5%	8.6%

To assess the students' opinion on the level of knowledge of their college peers, they were asked "*How informed do you feel your fellow college students are regarding second-hand smoke?*". Most students (43.1%) agreed they were somewhat informed on the topic, followed by about 38% who agreed their peers were very informed on second-hand smoke. Less students (11.7%) believed their fellow college students were not at all informed, with only about 7% of students

unsure of their answer. When asked "*How informed do you feel your fellow college students are regarding third-hand smoke?*", students had significantly different opinions. Most students (43.7%) felt that their peers were not at all informed about the topic, with the next majority group of students (37.1%) stating they were somewhat informed. As stated in Table 9, 12.2% of students were not sure of their opinion, and only about 7% of students stated their peers were very informed on third-hand smoke.

Table 9. How Informed Do You Feel Your Fellow College Students are Regarding Second-hand Smoke/Third-hand Smoke?

	Second-hand smoke (SHS)	Third-hand smoke (THS)
Not at all informed	11.7%	43.7%
Somewhat informed	43.1%	37.1%
Very informed	38.1%	7.1%
Not sure	7.1%	12.2%

The survey was used to understand students' opinion towards their peers, including their friends. When asked the question "*How informed do you feel your friends are regarding second-hand smoke?*", about half of the students answered, "Somewhat Informed" (50.3%). Similarly, 33.5% of students stated they were very informed regarding second-hand smoke while only 11.5% of students felt their friends were not informed at all. Only about 5% of students were unsure of their answer regarding their friends' level of knowledge of second-

hand smoke. In comparison, when questioned "*How informed do you feel your friends are regarding third-hand smoke?*", more than half of the students agreed their friends were not at all informed (54.8%). Only about 30% of students felt their friends were somewhat informed, however around 11% were unsure of their answer. Only about 4% of students believed their friends were very informed on third-hand smoke.

Table 10. How Informed Do You Feel Your Friends are Regarding Second-hand smoke/Third-hand Smoke?

	Second-hand smoke (SHS)	Third-hand smoke (THS)
Not at all informed	11.2%	54.8%
Somewhat informed	50.3%	29.9%
Very informed	33.5%	4.1%
Not sure	5.1%	11.2%

To gauge the student's opinion on their social environment at home, they were asked "*How informed do you feel your community/where you live are regarding second-hand smoke?*". About 51% of respondents agreed their community was somewhat informed, however about 21% of the respondents disagreed and stated they were not at all informed on second-hand smoke. Only about 13% of students felt their communities were very informed, while a similar percentage of students (12%) were not sure. When asked "*How informed do you feel your community/where you live are regarding third-hand smoke?*", there was a significant difference in responses. About 60% of students felt their community

was not at all informed, followed by around 20.8% of respondents who disagreed and stated they were somewhat informed. A larger percentage of students (17.2%) were unsure of their opinion while only 1.5% of students agreed their communities were very informed on their knowledge of third-hand smoke.

Table 11. How Informed Do You Feel Your Community/Where You Live are Regarding Second-hand Smoke/Third-hand Smoke?

	Second-hand smoke (SHS)	Third-hand smoke (THS)
Not at all informed	20.8%	60.4%
Somewhat informed	50.8%	20.8%
Very informed	13.2%	1.5%
Not sure	12.2%	17.3%

Students were surveyed on the likelihood of discussing information with their families, peers, and community organizations in general regarding SHS or THS. Regarding their family, most students agreed they were highly likely/likely to discuss SHS or THS with family (70.4%). About 17% of students were unsure if they would discuss the topics with their family, and about 13% confirmed it was unlikely/highly unlikely.

Table 12. How Likely are You to Discuss the Issue of Second-hand Smoke or Third-hand Smoke with Your Family?

Highly Likely/Likely	70.4%
Not Sure	16.8%
Unlikely/Highly Unlikely	12.8%

When questioned about their willingness to discuss the topics with their peers, most students (61.7%) agreed they were highly likely/likely to participate in discussion. In contrast, almost 16% stated they were unlikely. highly unlikely, and about 22% were unsure of their intentions.

Table 13. How Likely are You to Discuss the Issue of Second-hand Smoke or Third-hand Smoke with Your Peers?

Highly Likely/Likely	61.7%
Not Sure	22.4%
Unlikely/Highly Unlikely	15.8%

Table 14 outlines the survey results to the question "*How likely are you to discuss the issue of secondhand smoke or thirdhand smoke with a community organization?*". Fewer students (44.9%) were highly likely/likely to discuss the topics with a community organization, while 26% confirmed they were unlikely/highly unlikely. Almost 30% of students were unsure if they would participate in discussion regarding the topics with a community organization.

Table 14. How Likely are You to Discuss the Issue of Second-hand Smoke or Third-hand Smoke with a Community Organization?

Highly Likely/Likely	44.9%
Not Sure	29.1%
Unlikely/Highly Unlikely	26.0%

Students' intentions to research SHS and THS on their own were assessed through the questions "*How likely are you to research more on secondhand smoke?*" and "*How likely are you to research more on thirdhand smoke?*". Regarding SHS, more than half of respondents (57.1%) stated they were highly likely/likely to do more research, while almost 20% were unsure. Only 23% of respondents stated they were unlikely/highly unlikely to do more research on the topic.

Results were similar regarding THS, with about 63% of respondents agreeing they were highly likely/likely to do more research, while around 19% were unsure of their intentions. Around 19% of respondents confirmed they were unlikely/highly unlikely to do more research on THS on their own.

Table 15. How Likely are You to Research More on Second-hand Smoke/Third-hand Smoke?

	Second-hand smoke (SHS)	Third-hand smoke (THS)
Highly Likely/Likely	57.1%	63.3%
Not Sure	19.9%	17.9%

Unlikely/Highly Unlikely	23.0%	18.9%

Lastly, student behavior regarding tobacco products was assessed through the question "*Do you currently use any tobacco products?*". There was a significant difference between responses with only 4.6% of respondents confirming they do use tobacco products while 95.4% stated they do not.\

Table 16. Do You Currently Use Any Tobacco Products?

No	4.6%
Yes	95.4%

CHAPTER FOUR:

DISCUSSION

This study analyzes the knowledge, attitudes, and practices of college students regarding second-hand smoke (SHS) and third-hand smoke (THS), and tobacco products in general. The questionnaire's results demonstrate a significant lack of knowledge about third-hand smoke, with results varying for second-hand smoke. This can be attributed to second-hand smoke already being a topic of discussion for the general public, while THS can be categorized as a fairly recent discovery with studies still under development. Regardless, students agreed SHS and THS are not receiving enough attention yet were willing to share information they received on the topics with their peers, communities, and fellow college students.

The study results did find that most students were interested in the topics and were willing to do research on their own, however it is important to address the students who were unsure or stated they were unlikely to do their own research, which comprised more than 30% of students combined.

As an education institution, it would be beneficial to act in accordance with the students' willingness to learn and to share educational knowledge with the different people they encounter in their daily lives and provide them with a foundation of knowledge on these topics. It would be valuable for the institution to ensure all general education classes provided by their appropriate department

implement updated curricula when discussing topics of tobacco to include topics such as THS and current tobacco products such as vapes. General education classes should be the focus since students of non-health majors often take these courses as a requirement, often serving as their only source of information on tobacco use and the health effects caused.

The results suggest students are less likely to discuss the topics of SHS and THS with community organizations, which can impact the services they may need and limit their education sources on the topics. For example, a student that may need cessation resources may feel hesitant to reach out to a community organization they are unfamiliar with and decide not to take action due to this unwillingness. Due to this, students should have access to local resources offered directly by their institution. The institution's health center offers links to informational websites for “Smoking” under the Resources tab, however this is not sufficient, especially when college students may not always correlate having a smoking or nicotine addiction with vaping. It would be beneficial for the institution health centers to provide intervention methods available on campus for students to sign up with versus directing them to third-party resources. This could be through the creation of a campus-wide anti-smoking initiative and hosting on-campus intervention groups that utilize face-to-face sessions to build a rapport and solid foundation.

The study results confirmed there is education lacking regarding tobacco SHS/THS health effects which may influence behaviors. Effective tobacco

education, specifically in SHS/THS, is key for any institution to implement tobacco advocacy programs or tobacco-free environments. In a study conducted across five universities in the United States with a Tobacco-Free Generation Campus Initiative (TFGCI), the prevalence of tobacco after the implementation of tobacco-free policies was analyzed. The study found that the majority of the college population in these universities were in support of tobacco-free policies on their campus before and after the study, however the usage of Electronic Nicotine Delivery Systems (ENDS) increased despite the student support (Nyman et al., 2022).

Key findings of this study found that additional programs, messaging, and educational campaigns are needed to support tobacco-free policies and to spread effective change. The study found that highlighting the health effects of these tobacco products, along with cessation resources, would encourage compliance with policies on campus (Nyman et al., 2022). The current literature supports the findings and recommendations of this study and thus the need for education on tobacco prevention is in order. This would encourage college-student led action and advocacy. This should be taken into consideration when reviewing the results to the question “Do you currently use any tobacco products?” as they contrast with current popularity rates of non-combustible products among youth and college-aged individuals.

Strengths and Limitations

This study was a cross-sectional study using survey data self-reported by the survey participants. Hence, this design of study was not without limitations. Due to the study design being a cross-sectional study, data was collected only during one point in time with no follow up with participants. This did not allow observation of any changes in student knowledge, attitude, or practice towards FHS, SHS, or THS. This design of study also prohibits determining a cause-and-effect relationship between the variables.

The data collection used self-reporting answers. Participants were asked closed-ended questions and were given a limited number of answers for most questions. Due to asking participants to describe their own knowledge, attitude, and practices on the topics, self-report bias could have been created. Moreover, questions on attitude and behaviors regarding tobacco products were included, introducing social desirability bias. Some participants may have felt uncomfortable or worried about sharing completely honest answers due to having concerns they might be identified or judged. Further, if participants did not know how to answer the question, or if none of the answers fit their beliefs accurately, the survey results could be skewed to a degree. Participants were asked to define certain terms they may have learned from previous events, possibly introducing recall bias if they were unable to remember past knowledge accurately.

Despite the limitations, the study has many strengths. The study design of a cross sectional study allows observations to be made on the current situation of tobacco knowledge, attitude, and practice (KAP) among college students. This serves as a basic foundational needs assessment for future research on the topic and intervention methods for this specific institution. Further, the anonymous nature of the survey creates a safe space for participants to answer truthfully, in turn, reducing the risk of social desirability bias.

Furthermore, the survey questionnaire was developed using the KAP model and pre-existing surveys, thus lowering the risk of instrumentation bias. Likewise, limiting responses to a specific number, applying a survey delivery method familiar to the population, and using simple language through the survey minimized instrumentation bias. The selection of participants throughout the institution also ensured the study was not over-sampling a specific course or major, thus ensuring representation of the student population.

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Conclusion

The purpose of this study was to assess the knowledge, attitudes, and practices (KAP) of students regarding first-hand smoke (FHS), second-hand smoke (SHS), and third-hand smoke (THS) at a college institution in Southern California. A cross-sectional method was used using self-reported data collected through an anonymous online survey. Results demonstrated an obvious lack of

knowledge regarding SHS and THS within this population. Participants also felt there was not enough attention given to these topics, especially to THS.

Additionally, the study found most students were willing to discuss these topics with the individuals in their social circles, ranging from peers to family members. To close the gaps of knowledge regarding the health effect of tobacco products, further research is recommended utilizing this needs assessment data to promote student-led advocacy to improve tobacco related health literacy initiatives. For example, educational institutions should incorporate updated curricula on tobacco products and their health effects wherever possible, such as in general education health courses and mandatory health education requirements. This would create movement within the student population led by their peers, with potential to reach their personal communities outside the institution and promote a culture of prevention through population-led initiatives.

APPENDIX A:

INSTITUTIONAL REVIEW BOARD LETTER OF APPROVAL

March 20, 2023

CSUSB INSTITUTIONAL REVIEW BOARD
Protocol Change/Modification
IRB-FY2022-196
Status: Approved

Prof. Monideepa Becerra, Prof. Benjamin Becerra, and Prof. Salome Mshigeni
CNS - Health Science, JHBC - Info & Decision Sci
California State University, San Bernardino
5500 University Parkway
San Bernardino, California 92407

Dear Prof. Becerra, Prof. Becerra and Prof. Mshigeni:

The protocol change/modification to your application to use human subjects, titled "Student perception of tobacco use and policy" has been reviewed and approved by the Chair of the Institutional Review Board (IRB). A change in your informed consent requires resubmission of your protocol as amended. Please ensure your CITI Human Subjects Training is kept up-to-date and current throughout the study. A lapse in your approval may result in your not being able to use the data collected during the lapse in your approval.

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.

You are required to notify the IRB of the following by submitting the appropriate form (modification, unanticipated/adverse event, renewal, study closure) through the online Cayuse IRB Submission System.

1. If you need to make any changes/modifications to your protocol submit a modification form as the IRB must review all changes before implementing them in your study to ensure the degree of risk has not changed.
2. If any unanticipated adverse events are experienced by subjects during your research study or project.
3. If your study has not been completed submit a renewal to the IRB.
4. If you are no longer conducting the study or project submit a study closure.

You are required to keep copies of the informed consent forms and data for at least three years.

If you have any questions regarding the IRB decision, please contact Michael Gillespie, Research Compliance Officer. Mr. 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-FY2022-196 in all correspondence.

Best of luck with your research.

Sincerely,

King-To Yeung

King-To Yeung, Ph.D., IRB Chair
CSUSB Institutional Review Board

REFERENCES

Akter, S., Goto, A., & Mizoue, T. (2017). Smoking and the Risk of Type 2 Diabetes in Japan: A Systematic Seview and Meta-analysis. *Journal of Epidemiology*, *27*(12), 553–561. https://doi.org/10.1016/j.je.2016.12.017

Anderson, T. M., Lavista Ferres, J. M., Ren, S. Y., Moon, R. Y., Goldstein, R. D., Ramirez, J. M., & Mitchell, E. A. (2019). Maternal smoking before and during pregnancy and the risk of sudden unexpected infant death. *Pediatrics*, *143*(4), e20183325. https://doi.org/10.1542/peds.2018-3325

Andreotti, G., Freedman, N. D., Silverman, D. T., Lerro, C. C., Koutros, S., Hartge, P., Alavanja, M. C., Sandler, D. P., & Freeman, L. B. (2017). Tobacco use and cancer risk in the Agricultural Health Study. *Cancer epidemiology, biomarkers & prevention : a publication of the American Association for Cancer Research, cosponsored by the American Society of Preventive Oncology*, *26*(5), 769–778. https://doi.org/10.1158/1055-9965.EPI-16-0748

Centers for Disease Control and Prevention. (2014). *Smoking and Cardiovascular Disease*. https://www.cdc.gov/tobacco/data_statistics/sgr/50th-anniversary/pdfs/fs_smoking_CVD_508.pdf

Centers for Disease Control and Prevention. (2018, July 30). *Smokeless tobacco: products and marketing*. Centers for Disease Control and Prevention.

https://www.cdc.gov/tobacco/data_statistics/fact_sheets/smokeless/products_marketing/index.htm

Centers for Disease Control and Prevention. (2019a, January 2). *About OSH*. Centers for Disease Control and Prevention. https://www.cdc.gov/tobacco/about/osh/index.htm

Centers for Disease Control and Prevention. (2019b, June 25). *Heart disease and stroke*. Centers for Disease Control and Prevention. https://www.cdc.gov/tobacco/basic_information/health_effects/heart_disease/index.htm

Centers for Disease Control and Prevention. (2019, August 27). Cancer and tobacco use - vital signs - CDC. Centers for Disease Control and Prevention. Retrieved February 14, 2022, from https://www.cdc.gov/vitalsigns/cancerandtobacco/index.html#:~:text=adults%20each%20year.-,Tobacco%20use%20is%20the%20leading%20preventable%20cause%20of%20cancer%20and,getting%20or%20dying%20from%20cancer.

Centers for Disease Control and Prevention. (2020a, October 6). *Tobacco-related mortality*. Centers for Disease Control and Prevention. https://www.cdc.gov/tobacco/data_statistics/fact_sheets/health_effects/tobacco_related_mortality/index.htm#shs-death

Centers for Disease Control and Prevention. (2020b, December 16). *Heated tobacco products*. Centers for Disease Control and Prevention.

https://www.cdc.gov/tobacco/basic_information/heated-tobacco-products/index.html

Centers for Disease Control and Prevention. (2020, April 28). Heart disease and stroke. Centers for Disease Control and Prevention. Retrieved February 17, 2022, from https://www.cdc.gov/tobacco/basic_information/health_effects/heart_disease/index.htm

Centers for Disease Control and Prevention. (2021, April 2). Cancer. Centers for Disease Control and Prevention. Retrieved February 10, 2022, from https://www.cdc.gov/tobacco/basic_information/health_effects/cancer/index.htm

Centers for Disease Control and Prevention. (2021, January 5). *Secondhand smoke (SHS) facts*. Centers for Disease Control and Prevention. Retrieved February 20, 2022, from https://www.cdc.gov/tobacco/data_statistics/fact_sheets/secondhand_smoke/general_facts/index.htm

Centers for Disease Control and Prevention. (2022). Centers for Disease Control and Prevention; U.S. Department of Health & Human Services. https://www.cdc.gov/

Chang, J. T., Meza, R., Levy, D. T., Arenberg, D., & Jeon, J. (2021). Prediction of COPD risk accounting for time-varying smoking exposures. *PloS one*, *16*(3), e0248535. https://doi.org/10.1371/journal.pone.0248535

Cigarettes and other tobacco products drug facts. (n.d.). National Institute on Drug Abuse; National Institutes of Health; U.S. Department of Health and Human Services. https://nida.nih.gov/download/1103/cigarettes-other-tobacco-products-drugfacts.pdf?v=2d6297f81552de80bfdb2bf3a02edee9

DiGiacomo, S. I., Jazayeri, M. A., Barua, R. S., & Ambrose, J. A. (2018). Environmental Tobacco Smoke and Cardiovascular Disease. *International Journal of Environmental Research and Public Health*, *16*(1), 96. https://doi.org/10.3390/ijerph16010096

Hang, B., Wang, P., Zhao, Y., Chang, H., Mao, J. H., & Snijders, A. M. (2019). Thirdhand smoke: genotoxicity and carcinogenic potential. *Chronic diseases and translational medicine*, *6*(1), 27–34. https://doi.org/10.1016/j.cdtm.2019.08.002

Hang, Bo et al. "Adverse health effects of thirdhand smoke: from cell to animal models." *International Journal of Molecular Sciences* vol. 18,5 932. 28 Apr. 2017, doi:10.3390/ijms18050932

Hong, Y., Mitchell, S. G., Peterson, J. A., Latkin, C. A., Tobin, K., & Gann, D. (2005). Ethnographic Process Evaluation: Piloting an HIV Prevention Intervention Program Among Injection Drug Users. International Journal of Qualitative Methods, 1–12. https://doi.org/10.1177/160940690500400101

Jacob, P., 3rd, Benowitz, N. L., Destaillats, H., Gundel, L., Hang, B., Martins-Green, M., Matt, G. E., Quintana, P. J., Samet, J. M., Schick, S. F., Talbot, P., Aquilina, N. J., Hovell, M. F., Mao, J. H., & Whitehead, T. P. (2017).

Thirdhand smoke: new evidence, challenges, and future directions. Chemical research in toxicology, 30(1), 270–294. https://doi.org/10.1021/acs.chemrestox.6b00343

Jeon, J., Holford, T. R., Levy, D. T., Feuer, E. J., Cao, P., Tam, J., Clarke, L., Clarke, J., Kong, C. Y., & Meza, R. (2018). Smoking and lung cancer mortality in the United States from 2015 to 2065: A comparative modeling approach. *Annals of internal medicine*, *169*(10), 684–693. https://doi.org/10.7326/M18-1250

Kim, A. S., Ko, H. J., Kwon, J. H., & Lee, J. M. (2018). Exposure to Secondhand Smoke and Risk of Cancer in Never Smokers: A Meta-Analysis of Epidemiologic Studies. *International Journal of Environmental Research and Public Health*, *15*(9), 1981. https://doi.org/10.3390/ijerph15091981

Korsbæk, N., Landt, E. M., & Dahl, M. (2021). Second-Hand Smoke Exposure Associated with Risk of Respiratory Symptoms, Asthma, and COPD in 20,421 Adults from the General Population. *Journal of Asthma and Allergy*, *14*, 1277–1284. https://doi.org/10.2147/JAA.S328748

Lima, L. L., Cruz, C., Fernandes, A., Pinheiro, G. P., Souza-Machado, C., Lima, V. B., Mello, L. M., & Cruz, Á. A. (2020). Exposure to Secondhand Smoke Among Patients with Asthma: a Cross-sectional Study. *Einstein (Sao Paulo, Brazil)*, *18*, eAO4781. https://doi.org/10.31744/einstein_journal/2020AO4781

McCauley, D. M., Gaiha, S. M., Lempert, L. K., & Halpern-Felsher, B. (2022). Adolescents, Young Adults, and Adults Continue to Use E-Cigarette Devices and Flavors Two Years after FDA Discretionary Enforcement. *International Journal of Environmental Research and Public Health*, *19*(14), 8747. https://doi.org/10.3390/ijerph19148747

Merianos, A. L., Jandarov, R. A., & Mahabee-Gittens, E. M. (2019). Association of Secondhand Smoke Exposure with Asthma Symptoms, Medication Use, and Healthcare Utilization Among Asthmatic Adolescents. *The Journal of Asthma : Official Journal of the Association for the Care of Asthma*, *56*(4), 369–379. https://doi.org/10.1080/02770903.2018.1463379

NIDA. 2021, April 6. Cigarettes and other tobacco products drugfacts. Retrieved from http://nida.nih.gov/publications/drugfacts/cigarettes-other-tobacco-products on 2023, April 9

Nyman, A., Jivani, S., Jazwa, A., Heath, E., Redmon, P. B., Sinha, B., & Eriksen, M. P. (2022). Student Tobacco Use, Secondhand Smoke Exposure, and Policy Beliefs Before and After Implementation of a Tobacco-Free Campus Policy: Analysis of Five U.S. College and University Campuses. *SSRN Electronic Journal*, *166*(0091-7435). https://doi.org/10.2139/ssrn.4060065

Pan, B., Jin, X., Jun, L., Qiu, S., Zheng, Q., & Pan, M. (2019). The relationship between smoking and stroke: A meta-analysis. *Medicine*, *98*(12), e14872. https://doi.org/10.1097/MD.0000000000014872

Products, C. for T. (2021). Chemicals in Tobacco Products and Your Health. *FDA*. https://www.fda.gov/tobacco-products/health-effects-tobacco-use/chemicals-tobacco-products-and-your-health

Products, C. for T. (n.d.). Smokeless Tobacco Products. U.S. Food and Drug Administration. Retrieved February 18, 2022, from https://www.fda.gov/tobacco-products/products-ingredients-components/smokeless-tobacco-products-including-dip-snuff-snus-and-chewing-tobacco

Rossheim, M. E., Zhao, X., Soule, E. K., Thombs, D. L., Suzuki, S., Ahmad, A., & Barnett, T. E. (2022). Aerosol, Vapor, or Chemicals? College Student Perceptions of Harm from Electronic Cigarettes and Support for a Tobacco-Free Campus Policy. *Journal of American College Health : J of ACH*, *70*(6), 1754–1760. https://doi.org/10.1080/07448481.2020.1819293

Sleiman, M., Gundel, L. A., Pankow, J. F., Jacob, P., 3rd, Singer, B. C., & Destaillats, H. (2010). Formation of carcinogens indoors by surface-mediated reactions of nicotine with nitrous acid, leading to potential thirdhand smoke hazards. Proceedings of the National Academy of Sciences of the United States of America, 107(15), 6576–6581. https://doi.org/10.1073/pnas.0912820107

Smoking and cardiovascular disease - centers for disease ... (n.d.). Retrieved February 12, 2022, from

https://www.cdc.gov/tobacco/data_statistics/sgr/50th-anniversary/pdfs/fs_smoking_CVD_508.pdf

Thirdhand smoke – What does the research say? | TRDRP. (2014). Www.trdrp.org. https://www.trdrp.org/news/thirdhand-smoke-jan-2016.html

U.S. Department of Health and Human Services. (2022, February 10). Vaping devices (electronic cigarettes) drugfacts. National Institutes of Health. Retrieved February 15, 2022, from https://nida.nih.gov/publications/drugfacts/vaping-devices-electronic-cigarettes

U.S. Department of Health and Human Services. (2022, February 7). Cigarettes and other tobacco products drugfacts. National Institutes of Health. Retrieved February 19, 2022, from https://nida.nih.gov/publications/drugfacts/cigarettes-other-tobacco-products

What is thirdhand smoke? (n.d.). Thirdhand Smoke Resource Center. Retrieved April 10, 2023, from https://thirdhandsmoke.org/about/what-is-ths/

Yang, W., Li, F., Li, C., Meng, J., & Wang, Y. (2021). Focus on Early COPD: Definition and Early Lung Development. *International Journal of Chronic Obstructive Pulmonary Disease*, *16*, 3217–3228. https://doi.org/10.2147/COPD.S338359