

2020

## Association of State Tobacco 21 Law with Tobacco Consumption Among Youth

Rebecca Adamson  
*Walden University*

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# Walden University

College of Health Sciences

This is to certify that the doctoral study by

Rebecca Adamson

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Dr. Chester Jones, University Reviewer, Public Health Faculty

Chief Academic Officer and Provost  
Sue Subocz, Ph.D.

Walden University  
2020

Abstract

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by

Rebecca Jane Adamson

MSN, Pittsburg State University, 1997

BSN, Pittsburg State University, 1994

Doctoral Study Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Public Health

Walden University

November 2020

## Abstract

The study is an investigation of the association between the Tobacco 21 Law and youth tobacco usage rates in Hawaii. Researchers have documented a gap in the research regarding the effectiveness of such laws. Several studies that have been conducted have shown mixed results. The purpose of this study was to better understand any association that may exist in Hawaii. The social ecological model (SEM) of health is the theoretical foundation for the study. The SEM of health includes five sources which influence health, and these consist of intrapersonal factors, interpersonal factors, institutional factors, community factors, and public policy. Tobacco use can be influenced via all five sources. The research questions focused on the relationship between the Tobacco 21 Law and youth tobacco usage rates and how usage rates differ between male and female youth as well as varied races. The effects of obesity, overweight, and alcohol use were also analyzed in relationship to tobacco use. The research design for the study was causal comparative. Data were obtained from the Centers for Disease Control and Prevention (CDC) Youth Risk Behavior Survey (YRBS) completed in 2015 and 2017. The target population was youth between the ages of 14 and 18. Data were analyzed using the Chi Square test and Logistic Regression. Results indicate that tobacco use among youth decreased after the passage of the Tobacco 21 law. Results also show that White and Asian participants were less likely to use tobacco compared to other races. The findings on the Tobacco 21 Law has the capability to create positive social change by decreasing the number of youth who use tobacco and the secondary effects that tobacco use will eventually have on youth as they age into adulthood.

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## Dedication

I would like to dedicate this dissertation to my Husband Michael and my children Jonathan, Joshua, Elizabeth, Jacob, as well as my daughter-in-law Elizabeth, my mother Lana and in loving memory of my Father Rodger. They have supported me throughout this journey, and I know that I would not have been able to succeed without their love and support. Above all thanks be to God. With God all things are possible.

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## Section 1: Foundation of the Study and Literature Review

### **Introduction**

Tobacco initiation and use among youth in the United States is an important public health issue (Centers for Disease Control and Prevention [CDC], 2019). Over 90% of adults who use tobacco start before the age of 18 and almost all adults who smoke or use tobacco products initiate that use before the age of 26 (U.S. Department of Health and Human Services, 2014). Youth are not the only population at risk for tobacco initiation and use but they are at an increased risk as they are not as mature as adults and often succumb to peer pressure (CDC, 2013). Youth are also at an increased risk as tobacco companies target this age group using innovative marketing techniques (CDC, 2019).

Studies have shown that youth become addicted to nicotine at a faster rate than adults and youth living in poverty are more likely to use tobacco products (CDC, 2019). Every day in the United States approximately 2,000 youth try their first cigarette (Substance Abuse and Mental Health Services Administration [SAMHSA], 2017). There are an additional 300 youth that become regular smokers in the United States every day (SAMHSA, 2017). Therefore, it is imperative to reduce the number of youth who smoke and use tobacco products. It is highly likely that youth who use tobacco products will become adults who use tobacco which increases the chance that they will have children who smoke and use tobacco products (CDC, 2019).

The Tobacco 21 Law prohibits the sale of tobacco containing products, including electronic cigarettes, to people under the age of 21 (Winickoff, 2018). According to King, Jama, Marynak, and Promoff (2015), raising the legal age to purchase tobacco to 21 is an effective way to reduce the number of youth who use the products. Making the use of tobacco seem abnormal to society plays an important role in reducing youth tobacco usage throughout the country (Winickoff, 2018). Ways that this has been accomplished is through taxation, laws creating smoke free spaces, tobacco cessation programs, and increasing the age in which youth can legally buy tobacco products (Winickoff, 2018).

If current tobacco usage rates continue among youth, thousands of youth living in the United States will die prematurely due to tobacco related causes (American Lung Association, 2017). One of the number one causes of death will be lung cancer (American Lung Association, 2017). There have been multiple attempts to decrease the rate of tobacco use among this population, but the Tobacco 21 Law is a novel approach. In Section 1, I will describe the problem statement, purpose of the study, research questions and hypotheses, foundation and nature of the study, and the literature review.

### **Problem Statement**

Tobacco initiation and use among youth in the United States is an extremely important public health issue. It is also an issue that public health practitioners and law makers alike must be concerned about and willing to act on immediately (CDC, 2017). The severity of the issue stems from the fact that most adults who use tobacco initiate use before turning 18 (CDC, 2017). The importance of this public health issue is extreme as

youth are an at-risk population when it comes to tobacco use (CDC, 2013). Tobacco companies target youth through marketing techniques knowing that young people are easier to persuade than their adult counterparts and more easily addicted to substances such as tobacco (CDC, 2017). It is imperative that public health practitioners work to reduce the number of youth that use tobacco products as they are more likely to become adults who use tobacco (CDC, 2017). Unfortunately, if youth usage rates continue as they are hundreds of thousands of Americans will experience adverse health effects due to tobacco use. These effects will include diseases such as lung cancer, heart disease, and chronic obstructive pulmonary disease (American Lung Association, 2017). The Tobacco 21 Law is an approach to tobacco control that can help to alleviate such issues and by researching the law public health practitioners will have increased leverage with law makers to ensure that the law is passed not only across the United States but in other countries as well.

There is a gap in the research literature as documented by Schneider, Buka, Dash, Winickoff, and O'Donnell, (2016). Even though raising the legal age to purchase tobacco products to 21 has gained momentum over the last several years there is little research examining the effect that this approach has had on youth tobacco rates (Schneider et al., 2016). Macinko and Silver (2018) also reported a gap in the research literature around this topic. Research regarding the influence that the Tobacco 21 law has had on youth tobacco initiation and use is limited (Macinko & Silver, 2018). There has been only one empirical study revealing a significant reduction in youth tobacco use after the initiation of the Tobacco 21 law (Macinko & Silver, 2018).

### **Purpose of the Study**

In this quantitative study, I examined the possible influence that the Tobacco 21 law (independent variable) has had on the rates of youth tobacco use (dependent variable) in the state of Hawaii. I also evaluated the relationship between the Tobacco 21 Law and youth tobacco use rates in male youth compared to female youth, as well as the different races of youth who participated in the Youth Risk Behavior Survey (YRBS). It is hoped that evidence from this study can be utilized to show the effectiveness of the Tobacco 21 Law in curbing youth tobacco initiation and use.

### **Research Questions and Hypotheses**

Research Question 1 (RQ1): What is the association of the Tobacco 21 Law and youth tobacco usage rates in Hawaii?

Null Hypothesis (H<sub>0</sub>1): There is no association between the Tobacco 21 Law and youth tobacco usage rates in Hawaii.

Alternative Hypothesis (H<sub>a</sub>1): There is an association between the Tobacco 21 Law and youth tobacco usage rates in Hawaii.

Research Question 2 (RQ2): To what extent did gender, race, obese (yes/no), overweight (yes/no), and alcohol (yes/no), use impact tobacco use (yes/no) before the Tobacco 21 Law in Hawaii?

Null Hypothesis (H<sub>0</sub>2): Gender, race, obese (yes/no), overweight (yes/no), and alcohol use (yes/no) were not associated with tobacco use before the Tobacco 21 Law in Hawaii.

Alternative Hypothesis: ( $H_{a2}$ ): Gender, race, obese (yes/no), overweight (yes/no), and alcohol use (yes/no) were associated with tobacco use before the Tobacco 21 Law in Hawaii.

Research Question 3 (RQ3): To what extent did gender, race, obese (yes/no), overweight (yes/no), and alcohol use (yes/no) impact tobacco use after the Tobacco 21 Law in Hawaii?

Null Hypothesis ( $H_03$ ): Gender, race, obese (yes/no), overweight (yes/no), and alcohol use (yes/no) were not associated with tobacco use after the Tobacco 21 Law in Hawaii.

Alternative Hypothesis ( $H_{a3}$ ): Gender, race, obese (yes/no), overweight (yes/no), and alcohol use (yes/no) were associated with tobacco use after the Tobacco 21 Law in Hawaii.

I tested the association between the Tobacco21 Law and youth tobacco usage rates in Hawaii. Hawaii passed a statewide Tobacco 21 Law on January 1st, 2016. I compared tobacco usage rates before the passage of the statewide law in 2015 to youth tobacco usage rates in 2017, 1 year after the passage of the statewide law. I also evaluated the influence of gender (male/female), race, obese (yes/no), overweight (yes/no), and alcohol use (yes/no) on youth tobacco usage rates. I compared the proportions from the YRBS) utilizing the Chi-Square test. I used logistical regression to analyze dichotomous variables.



### **Theoretical Foundation for the Study**

The theoretical framework for this study is the social ecological model (SEM) of health. The SEM of health identifies five sources that can influence health (Glanz, Rimer, & Viswanath, 2015). These five sources consist of intrapersonal factors, interpersonal factors, institutional factors, community factors, and public policy (Glanz et al., 2015). The model also states that health behavior is influenced by one's physical environment, social environment, and personal attributes (Glanz et al., 2015). The SEM of health postulates that individuals can influence their setting or environment and the setting can also influence the individual's health behaviors (Glanz et al., 2015). I used the SEM of health for this study because it has been used for many years for tobacco control programs (Glanz et al., 2015). This model can be used to create health promotion at the individual, broad environmental, and policy levels (Glanz et al., 2015). An example of this type of utilization of the model is when public health practitioners create public awareness campaigns to increase the knowledge of the public around the ill effects that nicotine can have on health. This type of message can influence health behaviors across multiple levels of the SEM of Health (Glanz et al., 2015). The Tobacco 21 Law and the issue of increasing the age to legally purchase tobacco products is a policy issue but can influence health behaviors across all levels of the SEM of health. By studying the influence that the Tobacco 21 Law has on youth tobacco usage rates public health

practitioners can show policy makers that it is an effective way to reduce tobacco use among youth which in turn can influence policy.

### **Nature of the Study**

This was a quantitative cross-sectional study. I evaluated the data at the state level. The state of Hawaii passed the Tobacco 21 Law statewide in 2016. I retrieved the data from the YRBS directly from the CDC. I analyzed the data from 2015, which is 1 year prior to the passage of the statewide Tobacco 21 Law in Hawaii, and then compared it to data from 2017 which is 1 year after the statewide law was passed in Hawaii. I used this comparison to determine if there is any association between tobacco use rates in youth after the passage of the tobacco 21 Law. I used the YRBS to gain access to secondary data. The YRBS is a source of secondary data that the United States government and the CDC provide to the public (CDC, 2017a). The YRBS surveys youth throughout the country to evaluate the rate of risky behaviors that youth participate in (CDC, 2017a). Tobacco use is included in the survey (CDC, 2017a). The variables that I used for this study included youth tobacco rates, before and after the passage of the Tobacco 21 Law statewide in Hawaii, among all youth along with tobacco use rates according to gender (male/female), race, obese (yes/no), overweight (yes/no), and alcohol use (yes/no). I requested the results of the YRBS from the CDC via email per the CDC's protocol for data requests. I used SPSS software to analyze the data.

### **Literature Search Strategy**

I conducted the literature search for this study by searching the Walden University Library, Google Scholar, Google, and WebMD for peer reviewed research articles written

within the last 5 to 10 years related to the effectiveness of the Tobacco 21 Law. Searches were also conducted to find peer reviewed research articles related to reduction in youth smoking due to the Tobacco 21 Law, youth opinions of the Tobacco 21 Law, policy change due to the Tobacco 21 Law, and the ethical acceptance of the Tobacco 21 Law. Peer reviewed research articles regarding the health benefits of the Tobacco 21 Law were also examined. Key search terms included: *Tobacco 21 Law*, *effectiveness of Tobacco 21 Law*, *youth opinions of Tobacco 21 Law*, and *ethical acceptance of Tobacco 21 Law*. I also conducted a search specific to the Tobacco 21 Law and Hawaii. The Walden University Library assisted in the literature search criteria for the study.

## **Review of the Literature**

### **Reductions in Youth Smoking in Relation to Tobacco 21**

Boyle, Kingsbury, and Parks, (2017) looked at the impact that raising the legal age to purchase tobacco products to 21 would have in Minnesota. They discussed that there was a nationwide campaign to raise the legal age to buy tobacco products from 18 years of age to 21 and at the time of the publication in 2017 there had been over 200 jurisdictions in 14 states that had implemented the new law. They also reviewed a 2015 publication from the Institute of Medicine that approximated the effects that the law had on a broad national level but recognized that little was known about the effects that the law has had at the state and local level. Their study considered the effect that the Minnesota Tobacco 21 Law had on smoking initiation within the State of Minnesota. The researchers used data from the Minnesota Adolescent Community Cohort (MACC) and the Minnesota Adult Tobacco Survey (MATS) to determine the rate of tobacco

initiation in a hypothetical cohort of youth aged 15 to 20 living in Minnesota. The researchers utilized expected reductions in tobacco initiation from the Institute of Medicine to statistically determine what the effects of the Tobacco 21 Law would be on smoking initiation within the cohort. The results of the study showed that by raising the legal age to purchase tobacco to 21 there would be 3,355 less Minnesota youth that initiate smoking.

Schneider, Buka, Dash, Winickoff, and O'Donnell (2016) made note of the fact that there is little evidence around the effectiveness of the Tobacco 21 Law. Schneider et al. (2016) performed a study utilizing census data to examine the effect that the Tobacco 21 Law has on youth tobacco use. There were over 16,000 study participants between 2006 and 2012. Cigarette purchasing was monitored in a city west of Boston that had already implemented the Tobacco 21 Law and this data was compared to cities without such a Law. The researchers found that youth smoking rates were significantly decreased in the community that had implemented the Tobacco 21 Law compared to the communities that did not have the law in place. The researchers recommend that the legal age to purchase tobacco products be raised to 21.

Macinko and Silver (2018) assessed the impact of the Tobacco 21 Law in New York City. They compared the youth tobacco rate of New York City to four cities in Florida using the YRBS. By doing this they found that tobacco use in youth decreased slightly in New York City after the implementation of the Tobacco 21 Law. This rate of decline was greater in areas of greater control. They also found that the use of electronic nicotine delivery systems increased during this time. They concluded that this could be

due to poor policy enforcement and public health officials wanting to implement the law should pay attention to how well the policy is enforced.

Kuipers et al., (2017) looked at the impact that laws restricting the sale of tobacco products to minors had in changing rates of youth tobacco use and how youth perceived the ability to obtain cigarettes over time in countries that had most recently introduced such laws. These countries were compared to countries in which age restrictive sales laws were already being fully implemented. They also tested if the trends were different between youth of higher socioeconomic status compared to those of low socioeconomic status. The countries that had recently put age restriction laws into place had restricted sales to youth over the age of 18 from at least 2007 to 2011 and those countries that had fully implemented the laws had done so since 2004. The researchers found that there was no difference in smoking prevalence between the countries but there was a significant decrease in the perceived ease of buying cigarettes among youth. Socioeconomic status did not have an impact on perceived ease of buying cigarettes. The researchers concluded that the age restrictive laws did not necessarily decrease youth tobacco use, but they did increase the perceived difficulty of buying cigarettes among youth.

Forster et al., (1998) conducted a randomized community trial in fourteen Minnesota communities to evaluate how local tobacco policies affect youth tobacco usage rates. There were seven intervention communities that participated in a 32-month organizing effort. The goal was to change policies around tobacco and youth access to tobacco products. Each community passed a policy that limited youth access to tobacco. Tobacco purchases declined more in intervention communities than it did in control

communities. There was also a lower increase of daily smoking in youth among the intervention communities when compared to control communities. This study did show that laws that limit youth access to tobacco can have a positive effect on youth tobacco usage rates.

### **Health Benefits and Importance of Tobacco 21 Laws in Policy Change**

Ahmad (2005) analyzed how raising the minimum legal purchase age for cigarettes to 21 would affect smoking prevalence, net cost of compliance enforcement, and health benefits in quality of life years to the population over time. The researcher analyzed secondary data using a computer simulation model. Simulations were done on several different scenarios. One such scenario assumed that the age of initiation of smoking for those under 21 shifted by 3 years indicating that an 18-year-old is as likely to start smoking as a 15-year-old would be. In this case raising the legal age to buy cigarettes to 21 would reduce smoking for the adult population from 22.1% to 15.4%. Smoking prevalence would decrease from 20% to 6.6% in youth ages 14–17 and from 26.9% to 12.2% in youth ages 18–20. Smoking rates for those aged 21 and older would decrease from 21.8% to 15.5%. The Tobacco 21 Law would save the U.S. economy over 200 billion dollars and add 13 million quality of life years.

Ahmad and Billimek (2007) analyzed a 75 year dynamic simulation model that compared the long-term health benefits of increasing taxation of tobacco products compared to limiting youth access to such products by increasing the legal age to purchase tobacco products to the age of 21. The researchers found that by increasing the legal age to purchase tobacco products there would be a large decrease in youth smoking

rates but a smaller decrease in adults. This is better than the effect that raising taxes would have on smoking rates. Long term rates of adult smoking would decrease by over 13%. This would produce a cumulative gain of 109 quality of life years.

### **Youth Opinions of Tobacco 21 Laws**

Dai (2017) studied youth attitudes toward the Tobacco 21 Law and how those attitudes correlated with tobacco use. They stated that raising the legal age to buy tobacco to 21 is important as it can help to reduce the number of youth who use tobacco products. The data for the study were taken from the 2013 National Youth Tobacco Survey which included 13,583 participants. Participants ranged in age from 11 to 18 years old. The researchers analyzed the data to determine if there was a prevalence of support toward the Tobacco 21 law among youth. The researchers also evaluated whether attitudes toward the law were associated with smoking initiation among youth that were nonsmokers and intentions to stop using tobacco among youth who were already using tobacco. The researchers found that around 64% of participants were in support of the law. There was more support among junior high students compared to high school students. Girls were also more likely to be supportive of the law compared to boys. Nontobacco users were more supportive of the law compared to those who were already using some form of tobacco. Attitudes among youth were influenced by perceptions of dangers associated with tobacco use and by tobacco use of household members. Those who never smoked were less likely to initiate cigarette use and those who already smoked were found to be more likely to quit within the next year. The

researchers concluded that most of the youth in the United States are supportive of the Tobacco 21 Law and that their attitudes did correlate with smoking behaviors.

Tompkins et al., (2017) examined views of the Tobacco 21 Law among Appalachian youth. The researchers acknowledged that there have been multiple attempts to lower the rates of tobacco use among youth in the United States with one of these strategies being the Tobacco 21 Law which raises the legal age to buy tobacco products to the age of 21. They stated that this type of legislation is successful at stopping youth access to tobacco products at two of the most common main sources across the United States which include stores and older friends. They reported that other access points should be explored. The researchers stated that youth perspectives on the Tobacco 21 Law need to be considered as this may help to identify certain areas of challenge when implementing such laws, make apparent other alternative interventions, and help shape successful tobacco control policies in the future. The goal of the study was to look at how youth perceive the Tobacco 21 Law and to pinpoint common ways that youth in middle school and high school access tobacco products in rural and low-income Appalachian communities. The researchers used a cross-sectional survey that asked about perceptions and use of tobacco products. This survey was distributed to 426 youth living in regions of Kentucky and North Carolina. Questions in the survey revolved around perspectives that the youth had on the effect of the Tobacco 21 Law. The researchers used descriptive statistics to characterize the study participants perspectives of the Tobacco 21 Law. Open-ended questions were utilized so that study participants would have the opportunity to expand on the opinion of the Tobacco 21 Law.



Study results showed that the majority of participants, over 58%, felt like the same number of youth would use tobacco even if the legal age to purchase such products was raised to 21. Around 29% of the study participants felt as though fewer youth would use tobacco products due to the Tobacco 21 Law and 12% felt like more youth would use tobacco because of the law. The researchers found that there was a statistical difference among tobacco use status when friends' tobacco use was compared to whether study participants identified family members as a source of tobacco products. Friends using tobacco was shown to be more significant. Study participants did expand upon their views around the Tobacco 21 Law by answering the open-ended study questions. Most participants felt that there was inadequate enforcement of the Tobacco 21 Law in stores, they could still access tobacco products among family members and friends, and that the amount of tobacco products sold in the community was a barrier to successfully implementing the law. The researchers concluded that less than a third of the study participants felt like the Tobacco 21 Law would be successful in lowering the rate of tobacco use among youth in their community. These perspectives were related to participants' own tobacco use, being exposed to others that use tobacco products, and the beliefs that youth could still obtain tobacco products from family members and friends that used them. The open-ended questions did show that there can be obstacles to successfully implementing legislation such as the Tobacco 21 Law in the Appalachian community. The researchers also felt that more research is needed and should include youth perspectives while creating and implementing tobacco control policies and

legislation as well as looking at ways to reduce family members as sources of tobacco products for this population.

Unger et al., (1999) researched youth attitudes toward antitobacco policy laws in California and how this can relate to youth tobacco usage rates. The study consisted of 6,887 10<sup>th</sup> graders in California. Researchers collected data from 65 schools in 18 California Counties from 1996 to 1997. The researchers evaluated smoking status, attitudes toward anti-tobacco policies, and covariates such as age, gender, and ethnicity. The study showed that those who currently smoked were most likely to be aware of tobacco policies and those who did not smoke were most likely to be unaware of the policies. Youth who were current smokers were less supportive of tobacco regulating policies than youth who did not smoke. As youth transitioned from not smoking to smoking, they became less supportive of tobacco control policies.

### **Ethical Acceptability of the Tobacco 21 Law**

Morain and Malek (2017) examined the ethical acceptability of implementing legislation that limits youth access to tobacco products until the age of 21. They discussed that past efforts to decrease access to tobacco products has been successful as well as decreasing the rate of tobacco initiation and regular use of tobacco products among youth. The researchers acknowledged that previous efforts have focused on increasing the age to purchase tobacco products to 18 and enhancing the oversight of sales to increase compliance with the new laws.

They bring up a valid point that these previous efforts have not addressed social sources that youth can obtain tobacco from. This could include buying or borrowing

tobacco products from a friend or family member. Morain and Malek (2017) stated that social sources are one of the main sources of youth tobacco products. They stated that decreasing access via these social avenues is an important issue that must be addressed. They feel that the Tobacco 21 Law is one way to accomplish this because youth less than 21 years of age are less likely to have friends over the age of 20 that are willing to purchase the products for them. They also stated that if implemented throughout the United States the Tobacco 21 Law would improve public health in a substantial way. This would include over 200,000 fewer deaths related to smoking in youth born between 2010 and 2019 with the greatest health gains in youth between the ages of 15 and 17. They discuss that the Tobacco 21 Law, in some jurisdictions, has created a reduction in youth tobacco use of over 40% since the first law was passed. Morain and Malek (2017) stated that the health benefits of the Tobacco 21 Law are great enough to show its ethical acceptability. There are critics of the law that feel a person 18 or older should have the choice to purchase tobacco products since they are old enough to vote, enlist in the United States Armed Forces, and marry. Morain and Malek (2017) go on to argue against critics by stating that these activities are not all similar and should be examined separately. They discussed that tobacco use is different from these other activities and American freedoms in three ways.

The first difference is the risk to benefit profile of tobacco use compared to voting, getting married, or enlisting in the Armed Forces. This is the case because tobacco will only provide a temporary solution or pleasure and has been proven to be a health risk that can cause severe harm. In comparison marriage, voting, and enlisting in

the service create better outcomes or more pleasure than they do harm. This shows that the benefit of implementing the Tobacco 21 Law outweighs the risk of such implementation.

The second claim that the researchers made is that unlike voting, marriage, or military service tobacco products have been proven to be highly addictive. This fact is what makes regulating tobacco products so imperative. It shows that regulating tobacco should be different than regulating marriage, voting, or military service. Once again, the researchers demonstrated that the benefit of the law outweighs the risks.

The third difference that the researchers discussed between tobacco use and freedoms such as marriage, voting, and military service is that these all hold different value. Some freedoms hold more value than others. For example, getting married or being able to fight for one's country may be a core belief and of high value for some people. The value held for these things is greater for most people than using tobacco products.

The researchers also examined the ability of someone under the age of twenty-one to make solid decisions. Youth under the age of 21 may not have the capacity to be fully autonomous. It has been suggested in past research that those under the age of 21 have less capacity to make good decisions when compared to those over 21 (Morain and Malek, 2017). Decreased impulse control, an increased risk of folding to peer pressure, and seeking approval from others all put youth under the age of 21 at risk for increased risk taking and poor decision making (Morain and Malek, 2017). Youth may not

understand the ill consequences of tobacco use. By delaying the decision to use tobacco until the age of 21 ensures that the person is making a truly autonomous decision.

The researchers examined the fact that the Tobacco 21 Law is only a temporary restriction of ones' right to purchase and use tobacco products. This temporary restriction works to increase autonomy in the long run. Public health ethics allows for some restrictions of liberty to prevent harm to others. Tobacco has been proven to be highly harmful to the health and well-being of human beings. The researchers stated that tobacco is responsible for over 500,000 deaths per year. The Tobacco 21 Law reduces harm as it prevents the ill effects of tobacco use among youth under the age of 21. Without the law younger individuals are at risk for poor health outcomes due to using tobacco, should they choose to use it. Not only will it reduce harm, but it reduces such harm within a group of people that are vulnerable due to their age. Youth are an at-risk population that have been taken advantage of many times in the past. The researchers concluded that they have the evidence to prove that the Tobacco 21 Law is ethical and acceptable.

### **Tobacco 21 Law in Hawaii**

The State of Hawaii was the first state in the United States to raise the legal age to purchase tobacco to 21. Hawaii passed this law on January 1<sup>st</sup>, 2016. The law was passed with no exemptions for special populations. Glover-Kudon et al., (2019) assessed the impact of the Tobacco 21 Law on the sales of cigarettes and large cigars in Hawaii. The researchers utilized Nielsen data to assess sales before and after the passage of the law. Data were collected from large food sales stores for the years of 2012 to 2017 where

sales were greater than \$2,000,000 per year. The researchers utilized segmented regression analysis to estimate changes in the sales before and after the Tobacco 21 Law was passed across the State. Results indicated that sales per unit dropped by over 4% per month. The largest drop in sales was seen in large cigars. The researchers concluded that by implementing laws like the Tobacco 21 Law tobacco initiation may be prevented or delayed.

In summary it is apparent that there have been several research studies that have examined different aspects of the Tobacco 21 Law and the effectiveness of it. Some researchers have found that the law has had a positive effect on youth tobacco use where others have shown that there was little or no effect. One study showed that the Tobacco 21 Law may have correlated with an increase in the use of electronic cigarettes among youth. As most of the studies examined, for the purposes of this literature review, demonstrate a positive effect on youth tobacco use in relation to the Tobacco 21 Law there are still conflicting results. Further studies may aid in determining the laws effectiveness in a more substantial way.

**Table 1***Findings of Research Studies*

Researchers that Examined the Effects of Age Restrictive Laws on Tobacco Sales	Reduction in Youth Tobacco Use	No Change in Youth Tobacco Use	Increase in Youth Tobacco Use
Boyle, Kingsbury, and Parks (2017)	X		
Schneider et al., (2016)	X		
Macinko and Silver (2018)	X		X (increased use of electronic nicotine delivery systems)
Kuipers et al., (2018)		X	
Forster et al., (1998)	X		

**Definition of Terms**

For the purpose of the study youth are defined as those under the age of 21. The Tobacco 21 Law is a law that limits the purchase of tobacco products until the age of 21. Gender is defined as male or female and race is defined as Asian, American Indian, Hispanic, Alaska Native, Hawaiian Islander, White, or Black. Overweight as defined by the CDC (2017c) is a BMI of 25 to less than 30 and obese is a BMI of 30 or higher.

**Assumptions**

It is believed that the Tobacco 21 Law will be shown to be associated with a decrease in the rate of youth tobacco use among youth living in Hawaii. This assumption

is critical to the meaningfulness of the study as it will assist in showing the importance that such laws can have on society by reducing health risks related to tobacco use among youth. It is important to assume that the law has and can make a difference to proceed with the research itself. If it were felt that the law has had no positive effect on youth tobacco usage rates in the past there would be no indication to study, it further.

### **Scope and Delimitations**

The State of Hawaii was selected as the Tobacco 21 Law was passed throughout the entire State January 1<sup>st</sup>, 2016. This makes it possible to analyze youth tobacco usage rates one year prior to the passage of the law and one year after the passage of the law. This does limit the generalizability of the study as not all States within the United States were studied. The covariates of gender, race, overweight, obesity, and alcohol were included due to limitations of the YRBS survey that has been predetermined by the CDC. This could also limit the scope of the research findings.

### **Summary**

Youth tobacco use is a public health issue, throughout the world, with serious health consequences. Different strategies have been utilized to taper such use. One approach is age limitations set by laws that keep youth from purchasing tobacco products until the age of 18. Over the last decade new laws have been established to increase the age requirement to 21. These laws are referred to as Tobacco 21. Several studies have been performed to evaluate the effectiveness of such laws but have given mixed reviews. Further studies are needed to establish the importance of such interventions. This study helps to fill the research gap around the law and advance the knowledge base of the



effectiveness of the law. Public health practitioners will be able to utilize the data from this research to educate law makers, regardless of the country or jurisdiction, on the importance of passing the law to improve health outcomes of all youth.

## Section 2: Research Design and Data Collection

In this quantitative study, I examined the impact that the Tobacco 21 Law (independent variable) has had on the rates of youth tobacco use (dependent variable) in the State of Hawaii. I evaluated the relationship between the Tobacco 21 Law and youth tobacco use rates according to gender (male/female), race, obese (yes/no), overweight (yes/no), and alcohol use (yes/no) in Hawaii. Results from this study can be utilized to educate public health practitioners and policy makers, regardless of country or jurisdiction, around the possibility that the Tobacco 21 Law significantly decreases youth tobacco initiation and use.

In section two I will explain the study's research design and rationale. This will include the research questions, variables, purpose of the study, methodology including the population, and data collection. I will also explain instrumentation and operationalization including a discussion of reliability, validity, and how variables were measured. Data analysis including software, data cleaning, data screening, hypotheses testing, key parameters, threats to validity, ethical procedures, and a summary will also be provided.

### **Research Design and Rationale**

I have examined the relationship between the independent variable Tobacco 21 Law, covariates gender (male/female), race, obese (yes/no), overweight (yes/no), and alcohol use (yes/no) through the research questions I have chosen along with their hypotheses.

Research Question 1 (RQ1): What is the association of the Tobacco 21 Law and youth tobacco usage rates in Hawaii?

Null Hypothesis ( $H_01$ ): There is no association between the Tobacco 21 Law and youth tobacco usage rates in Hawaii.

Alternative Hypothesis ( $H_a1$ ): There is an association between the Tobacco 21 Law and youth tobacco usage rates in Hawaii.

Research Question 2 (RQ2): To what extent did gender, race, obese (yes/no), overweight (yes/no), and alcohol (yes/no) use impact tobacco use (yes/no) before the Tobacco 21 Law in Hawaii?

Null Hypothesis ( $H_02$ ): Gender, race, obese (yes/no), overweight (yes/no), and alcohol use (yes/no) were not associated with tobacco use before the Tobacco 21 Law in Hawaii.

Alternative Hypothesis: ( $H_a2$ ): Gender, race, obese (yes/no), overweight (yes/no), and alcohol use (yes/no) were associated with tobacco use before the Tobacco 21 Law in Hawaii.

Research Question 3 (RQ3): To what extent did gender, race, obese (yes/no), overweight (yes/no), and alcohol use (yes/no) impact tobacco use after the Tobacco 21 Law in Hawaii?

Null Hypothesis ( $H_03$ ): Gender, race, obese (yes/no), overweight (yes/no), and alcohol use (yes/no) were not associated with tobacco use after the Tobacco 21 Law in Hawaii.

Alternative Hypothesis (H<sub>a3</sub>): Gender, race, obese (yes/no), overweight (yes/no), and alcohol use (yes/no) were associated with tobacco use after the Tobacco 21 Law in Hawaii.

### **Research Design**

The causal comparative research design is a tool for exploring differences between or among pre-existing groups on outcomes and dependent variables (Schenker & Rumrill, 2004). While experimental designs have the potential to provide evidence for causal relationships, there are many instances where the independent variable cannot be manipulated. Gender (male and female) and race are preexisting groups that require a nonmanipulation research design. Furthermore, the causal comparative research design is used to evaluate nominal independent variables on continuous dependent variables. A causal comparative research design is necessary to evaluate a possible relationship between race, gender, and the Tobacco 21 Law. The relationship between the covariates race, gender, and the Tobacco 21 Law on youth tobacco use rates is largely unexplored (Forster et al, 1998).

### **Methodology**

In this section I will explain the sample population, data collection, instrumentation, operationalization, and data analysis plan.

#### **Population**

According to the CDC (2013), the target population for youth tobacco use was youth between ninth and 12th grade, ages ranging from 14 years old to 18 years old with a median age of 16 living in Hawaii. A sample of 33 high schools produced 6,089

completed questionnaires in 2015 (Hawaii Health Data Warehouse, 2016). A sample of 35 high schools produced 6,031 completed questionnaires in 2017 (Hawaii Health Data Warehouse, 2018).

### **Data Collection**

Variables were collected and measured by the CDC except for Tobacco 21 Laws which are measured by the Preventing Tobacco Addiction Foundation (CDC, 2013). The CDC's data collection was conducted as a cluster sample in three stages to produce a nationally representative sample (CDC, 2017). Cluster sampling produces homogeneous clusters, but each cluster can have a diverse population. Reputability, permissions, and access to the YRBS questionnaire are addressed in the instrument section. The CDC constructed three progressively smaller sampling units to select regions, physical schools, and individual classrooms. The first stage sampling frame constructs and selects primary sampling units (PSU) consisting of contiguous counties, or a singular county with a large population. PSUs are divided into classifications according to the percentage of Black and Hispanic students and PSUs are selected with probability proportional to enrollment size (CDC, 2013).

The second stage sampling frame constructs and selects schools from the selected PSUs. Schools that offered less than four grades were combined with other schools to form a cluster school, so that they could be compared with schools that offer four grades or whole schools. Schools were divided into either large or small schools where small schools have less than 25 students per grade. One small school and three large schools were selected.

The third stage sampling frame selects classrooms from the selected schools. One or two classes in each grade (9–12) were selected within each school and each PSU selected in Stages 1 and 3. All students in a classroom are eligible to participate. To ensure a representative sample, the CDC oversampled Black and Hispanic students by selecting four high-Black and high-Hispanic strata at each of the three levels of sampling. This allowed for the sampling process to insure the inclusion of high minority enrollment schools.

The YRBS questionnaire was administered by teachers following a standardized script. Students completed self-administered questionnaire booklets during one class period. Students were encouraged to use a sheet of paper to cover survey results to reduce the chance that an adjacent student could see their responses. The YRBS questionnaire was provided as a blueprint; however, states and large urban school districts could add and delete questions to gather specialized local data. The standard questionnaire contains 89 questions, and several questions include explanatory definitions. Electronic vapor products were enumerated by specific brand names to allow respondents to clearly identify tobacco use behaviors. Except for questions on race, all answers were mutually exclusive multiple choice. Questions on racial identity allowed respondents to mark all that apply.

All regular public schools, catholic schools, and charter schools with at least one grade between 9 and 12 were included (CDC, 2017). Special education schools, Department of Defense schools, Bureau of Indian Education schools, and vocational

schools serving only pull-out populations, and schools with less than or equal to 40 students were excluded (CDC, 2017 p.3).

Participation in the YRBS was voluntary, and parental permission was acquired following local and state procedures. States use active and passive parental permission, in which parents either opt in or opt out of questionnaire participation. Hawaii used opt-out permission for both the 2015 and the 2017 YRBS surveys (Hawaii Health Data Warehouse, 2016 & 2018). Data from the YRBS were statistically weighted by the CDC so that it was possible to make them valid statewide (Hawaii Health Data Warehouse, 2016).

Permissions to access the YRBS questionnaire data are controlled by the CDC and the state where the data were collected. The CDC administers a YRBS data request form that requires only an email address, name, and a request for selected localities. If a state has given distribution permission, the file will be emailed directly, for states that have not given distribution permission, the CDC provides contact information to request that data.

Data from 2015 constitutes the before case, while data from 2017 constitutes the after case. The State of Hawaii was selected as the Tobacco 21 Law was passed statewide in 2016 giving one full year of before case data and 1 full year of after case data. The vulnerability of this approach is addressed in threats to validity. The Preventing Tobacco Addiction Foundation measures up to date Tobacco 21 Laws (Preventing, 2019; Winickoff, 2018). State law and local ordinances are a matter of public record and require no recruitment, permission, or restrictions on access.

### **Instrumentation and Operationalization of Constructs**

The instrument was the YRBS questionnaire administered by the CDC. Questionnaires are the leading instrument to gather data on youth tobacco use rates (Brener, 2003). I utilized the YRBS to investigate the research questions and to obtain data from before and after the implementation of Tobacco 21 Laws on tobacco use rates, race, and gender. The CDC first began work to develop the YRBS questionnaire in 1989 and it was administered the next year (CDC, 2013).

Validity of the YRBS questionnaire is supported by a pair of literature reviews of adolescent self-reports of tobacco use in the academic literature. Cognitive factors may impact the validity of the YRBS questionnaire (CDC, 2013). Tobacco use questionnaires accurately record if tobacco has ever been used or is currently being used. However, frequency of use, and number of cigarettes used in a time period may be difficult for respondents to accurately recall since habitual behaviors can be difficult to report (Brener, 2013).

Reliability of the YRBS questionnaire is supported by test-retest studies investigating how question wording, self-reported height and weight, racial coding, mode and setting of the survey affects prevalence estimates. Internal reliability checks are performed to identify falsified answers (CDC, 2013). According to the CDC they ensure that survey respondents know that the questionnaire produces valuable data, and that privacy and anonymity is preserved to encourage truthful answers (CDC, 2013).



## **Operationalization**

The variables included youth tobacco use, Tobacco 21 Laws, gender, race, obese (yes/no), overweight (yes/no), and alcohol use (yes/no). Youth tobacco use was the dependent or response variable for each research question.

Youth tobacco use was operationalized as the aggregate of four survey questions: ever tried cigarette smoking (even one or two puffs), current cigarette use (at least 1 day during the 30 days before the survey), Current frequent cigarette use (on 20 or more days during the 30 days before the survey), and current daily cigarette use (on all 30 days during the 30 days before the survey). Youth tobacco use rates are measured using the YRBS.

Tobacco 21 Laws were an independent and explanatory variable for each research question. Tobacco 21 Laws were operationalized as legislation implemented to restrict the sale of tobacco products to youth below the age of 21, in the State of Hawaii. Data from 2015 were the before case, while data from 2017 were the after case. Up to date Tobacco 21 Laws are measured by the Preventing Tobacco Addiction Foundation (Preventing, 2019; Winickoff, 2018). Race and gender are identified as potential covariates (Forster et al, 1998).

The American Psychological Association (APA) defines gender as the social, psychological, and cultural characteristics associated with males and females (American Psychological Association [APA], 2018 p.2). For the purposes of the research questions, gender was operationalized as either male or female to limit the scope of the study. Gender was measured through survey results collected by the YRBS.

Race and ethnicity are typically broken down into the subcategories Asian, American Indian, Hispanic, Alaska Native, Hawaiian Islander, Black, and White. These racial and ethnic categories may limit how survey participants express their identity; however, they facilitate cross sectional analysis (APA, 2017 p.24). I measured race through survey results collected by the YRBS.

**Table 2***Variable Type, Measuring Instrument, Level of Measurement*

Variable	Categories	Variable Type	Instrument	Initial Level of Measurement
Youth tobacco use rates	Not Applicable	Response / Dependent	YRBS	Continuous Interval
Tobacco 21 Law	Before Passage or After Passage	Explanatory / Independent	Preventing Tobacco Addiction Foundation	Categorical Nominal
Gender	Male or Female	Covariate	YRBS	Categorical Nominal
Race	Asian, American Indian, Hispanic, Alaska Native, Hawaiian Islander, Black, and White	Covariate	YRBS	Categorical Nominal
Obese	Yes/No	Covariate	YRBS	Categorical
Overweight	Yes/No	Covariate	YRBS	Nominal
Alcohol	Yes/No	Covariate	YRBS	Categorical Nominal

## **Data Analysis Plan**

The software SPSS was used to conduct data analysis, data cleaning, screening procedures, and logistic regressions. Data cleaning involved removing survey respondents that left critical fields blank. Specifically, if any of the questions on gender, race, and the four questions used to aggregate tobacco use rate are left blank, they were removed from the data set. Prior to conducting logistic regressions, the researcher checked that assumptions for logistic regression had been met; dependent variable was dichotomous, had one or more predictors (interval, ordinal, or nominal), independence of observations, and test for linearity between the dependent variable and any continuous predictor.

Logistic regression is a tool that researchers use to predict the probability that a given observation falls in either group of a dichotomous dependent variable based on one or more predictors (interval, ordinal, or nominal) (Stoltzfus, 2011). The dependent variable had two possible groups such as yes or no, pass or fail, proceed, or stop which are encoded as 1 and 0. The model relied on the computation of odds ratios which indicated the likelihood of an observation falling in one of the two groups of the dependent variable (Stoltzfus, 2011). The odds ratios were also used in the computation of the probability of a given observation falling into either group of the outcome variable.

Data screening was used to select the variables of the study from before and after the passage of the Tobacco 21 Law in the State of Hawaii, including tobacco use rates, and the covariates race, gender, obese, overweight, and alcohol use. Specifically, the subcategories for gender: male and female were selected for analysis along with race,

obesity, overweight, and alcohol use. The survey data typically measures youth demographic rates with respect to tobacco use.

I utilized logistic regression to address the research questions and test the hypotheses recorded in table 2. Logistic regression before implementation of the Tobacco 21 Law and logistic regression after the implementation of the Tobacco 21 Law allowed me to assess the impact of the Tobacco 21 Law. I evaluated the effect of the law by using race and gender as covariates and predictors of tobacco use rates. Race and gender were included as covariates to glean a deeper understanding of youth tobacco use and the possible factors that contribute to tobacco use and initiation (Forster et al, 1998). It also established if there were differences between the logistic model before the Tobacco 21 Law and after the Tobacco 21 Law. To minimize the probability of producing a type I error, the null hypothesis was not rejected unless the P-Value was less than 0.05 to ensure that the odds ratios are unlikely to be due to random chance.

**Table 3***Research Questions, Variables, Hypotheses, and Hypothesis Testing*

Research Question	Explanatory Variable	Response Variable	Hypothesis Testing & Analysis	Null	Alternative
RQ 1- Quantitative: What is the association of the Tobacco 21 Law and youth tobacco usage rates in Hawaii?	Tobacco 21 Law	Tobacco use	Chi-square Test Logistic Regression	H <sub>0</sub> : There is no association between the Tobacco 21 Law and youth tobacco usage rates in Hawaii.	H <sub>A</sub> : There is an association between the Tobacco 21 Law and youth tobacco usage rates in Hawaii.
RQ 2- Quantitative: To what extent did gender (male/female), race, obese (yes/no), overweight (yes/no), and alcohol use (yes/no) impact tobacco use before the Tobacco 21 Law in Hawaii?	Gender, race, alcohol use, weight	Tobacco use	Logistic Regression	H <sub>0</sub> : Gender, race, obese (yes/no), overweight (yes/no), and alcohol use (yes/no) were not associated with tobacco use before the tobacco 21 Law in Hawaii.	H <sub>A</sub> : Gender, race, obese (yes/no), overweight (yes/no), and alcohol use (yes/no) were associated with tobacco use before the tobacco 21 Law in Hawaii.

**Table 3** (continued)

RQ 3- Quantitative: To what extent did gender, race, obese (yes/no), overweight (yes/no), and alcohol use (yes/no) impact tobacco use after the Tobacco 21 Law in Hawaii?	Gender, race, alcohol use, weight	Tobacco use	Logistic Regression	Ho: Gender, race, obese (yes/no), overweight (yes/no), and alcohol use (yes/no) were not associated with tobacco use after the Tobacco 21 Law in Hawaii.	H <sub>A</sub> : Gender, race, obese (yes/no), overweight (yes/no), and alcohol use (yes/no) were associated with tobacco use after the Tobacco 21 Law in Hawaii.
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### Threats to Validity

Internal validity may be threatened by an incentive for youths to misrepresent tobacco use and initiation behaviors since tobacco use is discouraged by authority figures and may cause an internal sense of shame. The extent of underreporting and overreporting cannot be determined. The data apply to youth who attend public school. Further investigation is needed to take advantage of quasi experimental designs arising from similar localities with and without Tobacco 21 laws, and for individual municipalities before and after Tobacco 21 laws.

External validity may be threatened by interaction effects between race and gender (Lavrakas, 2008). Utilizing a causal comparative research design does not guarantee external validity since it cannot be established that the non-manipulated independent variables caused the change in the dependent variable (Schenker & Rumrill,

2004). The external validity of the study may be questioned in its application to youth in general since the sample selection included high school students as the target population rather than all youth. Another issue that could arise is that communities of youth with low graduation rates, low high school attendance, or alternative pathways of education may not conform to the results. Further investigation is needed on the role of socioeconomic status, sexual orientation, and a wider analysis of race is needed to explain the possible confounding variables that impact the effectiveness of Tobacco 21 Laws on youth tobacco use rates.

### **Ethical Procedures**

The YRBS questionnaire is voluntary and anonymous (CDC, 2017; CDC 2013). Few ethical concerns arise as human participants are subjected to a short self-report survey booklet, have parental permission, and can opt out at any time, for any reason. No predicted adverse events were predicted by exposure to the questionnaire. The CDC has distribution permission for many States (CDC, 2017). For States that retain distribution permission, data will be protected by the principal investigator (CDC, 2017). IRB approval was obtained from Walden University per guidelines set by the University.

### **Summary**

The study examined the impact of the Tobacco 21 Law on youth tobacco use in the State of Hawaii by analyzing data collected by the CDC before and after the adoption of the Tobacco 21 Law statewide. The study also evaluated the relationship between the Tobacco 21 Law and youth tobacco use rates in male youth and female youth and the relationship between the Tobacco 21 Law on tobacco use rates in multiple races of youth.



The association of obesity, overweight, and alcohol to tobacco use was also analyzed.

The instrument was the YRBS questionnaire administered by the CDC. The YRBS

enabled the investigation of the research questions by providing data from before and

after the implementation of the Tobacco 21 Law on tobacco use rates with the covariates

of race, gender, obese, overweight, and alcohol use being analyzed. Logistic regression

was utilized to evaluate the Tobacco 21 Law as an independent or explanatory variable

and race, gender, obesity, overweight, and alcohol use as covariates of the dependent

variable. In section three I will address results, discussion, and conclusions.

### Section 3: Presentation of the Results and Findings

#### **Introduction**

The purpose of the present study was to examine the influence of the Tobacco 21 law on the rates of youth tobacco use in the state of Hawaii. Specifically, I examined youth tobacco usage rates before the passage of the Hawaii statewide law in 2015 compared to youth tobacco usage rates in Hawaii in 2017, 1 year after passing the statewide law. I also evaluated the relationship between the Tobacco 21 Law and youth tobacco use rates gender (male/female), race, obesity (yes/no), overweight (yes/no), and alcohol use (yes/no) on youth tobacco usage rates as well as the different races of youth who participated in the YRBS.

#### **Research Questions**

In this study I focused on identifying key variables related to the rates of youth tobacco use. The three research questions and hypotheses that guided this study were:

Research Question 1 (RQ1): What is the association of the Tobacco 21 Law and youth tobacco usage rates in Hawaii?

Null Hypothesis ( $H_0$ 1): There is no association between the Tobacco 21 Law and youth tobacco usage rates in Hawaii.

Alternative Hypothesis ( $H_a$ 1): There is an association between the Tobacco 21 Law and youth tobacco usage rates in Hawaii.

Research Question 2 (RQ2): To what extent did gender, race, obese (yes/no), overweight (yes/no), and alcohol (yes/no) use impact tobacco use (yes/no) before the Tobacco 21 Law in Hawaii?

Null Hypothesis ( $H_0$ 2): Gender, race, obese (yes/no), overweight (yes/no), and alcohol use (yes/no) were not associated with tobacco use before the Tobacco 21 Law in Hawaii.

Alternative Hypothesis: ( $H_a$ 2): Gender, race, obese (yes/no), overweight (yes/no), and alcohol use (yes/no) were associated with tobacco use before the Tobacco 21 Law in Hawaii.

Research Question 3 (RQ3): To what extent did gender, race, obese (yes/no), overweight (yes/no), and alcohol use (yes/no) impact tobacco use after the Tobacco 21 Law in Hawaii?

Null Hypothesis ( $H_0$ 3): Gender, race, obese (yes/no), overweight (yes/no), and alcohol use (yes/no) were not associated with tobacco use after the Tobacco 21 Law in Hawaii.

Alternative Hypothesis ( $H_a$ 3): Gender, race, obese (yes/no), overweight (yes/no), and alcohol use (yes/no) were associated with tobacco use after the Tobacco 21 Law in Hawaii.

To answer these research questions, I employed a quantitative research design. I utilized Chi-square analysis and logistic regression to test whether the independent variables were related to the dependent variables.

In this chapter I will give a review of the descriptive statistics of the variables of interest along with an examination of the data and test of assumptions for all variables. I will also present results from both the chi-square and logistic regression. I will conclude the chapter with a summary of the results.

### **Data Collection Methods**

The data were collected and measured by the CDC, except for Tobacco 21 Laws which were measured by the Preventing Tobacco Addiction Foundation between 2015 and 2017. The target population for youth tobacco use was youth between ninth and 12<sup>th</sup> grade, ages ranging from 14 years old to 18 years old with a median age of 16 living in Hawaii (CDC, 2013). Data were collected from 12,120 youths in the state of Hawaii, who participated in the YRBS. This met the criteria for the minimum sample requirements to detect an effect (i.e., the sample is greater than 500). Specifically, 6,089 completed the questionnaire before the Tobacco 21 Law and 6,031 completed the questionnaire after the Tobacco 21 Law.

### **Descriptive Statistics**

Participants were 12,120 youths in the state of Hawaii, who participated in the YRBS. Of the sample, 6,089 completed the questionnaire before the Tobacco 21 Law and 6,031 completed the questionnaire after the Tobacco 21 Law.

Across the dataset, there were 165 cases missing data for gender, 459 cases missing data for race, and 537 cases missing data for tobacco use. Based on the data analysis plan, I removed these cases from analysis because without these key variables' conclusions cannot be made, leaving a final sample of 11,143 participants. Specifically, a final sample of 5,494 completed the questionnaire before the Tobacco 21 Law and 5,649 completed the questionnaire after the Tobacco 21 Law.

For those who completed the YRBS before the Tobacco 21 Law, 51.6% were female and 48.4% were male. In addition, most of the participants were between the ages

of 14 to 17 (91.4%). For race or ethnicity, 30.9% were White, 25.9% were Asian, 17.6% were Native Hawaiian or Other Pacific Islander, 16.1% were Multiracial – Hispanic/Latino, and less than 10% were Hispanic/Latino, Black, American Indian or Alaskan Native. Most participants reported alcohol use (81.3%), whereas a small percentage of participants reported ever using cigarettes (27.7%), were considered overweight (14.5%), or obese (13.3%).

For those who completed the YRBS after the Tobacco 21 Law, 51.1% were female and 48.9% were male. In addition, most of the participants were between the ages of 14 to 17 (90.8%). For race or ethnicity, 30.0% were White, 25.0% were Asian, 19.8% were Native Hawaiian or Other Pacific Islander, 16.1% were Multiracial – Hispanic/Latino, and less than 10% were Hispanic/Latino, Black or African American, or American Indian or Alaskan Native. Most participants reported alcohol use (79.7%), whereas a small percentage of participants reported ever using cigarettes (11.6%), were considered overweight (14.5%), or obese (14.9%). Table 4 presents the characteristics of the sample by Tobacco 21 Law.

**Table 4**

*Descriptive Statistics for the Sample Characteristics*

Variable	Category	Tobacco 21 Law	
		Before n (%)	After n (%)
Gender	Female	2,833 (51.6%)	2,888 (51.1%)
	Male	2,661 (48.4%)	2,761 (48.9%)

**Table 4** (continued)

				30 (0.5%)
				16 (0.3%)
				774 (13.7%)
	12 or younger	12 (0.2%)		1,398
Age Category	13	6 (0.1%)		(24.7%)
	14	874 (15.9%)		1,565
	15	1,421 (25.9%)		(27.7%)
	16	1,373 (25.0%)		1,397
	17	1,352 (24.6%)		(24.7%)
	18 or older	453 (8.2%)		466 (8.2%)
				1,694
				(30.0%)
	White			1,412
	Asian	1,698 (30.9%)		(25.0%)
Race/ethnicity	Native American/Other Pacific Islander	1,422 (25.9%)		1,116
	Multiracial – Hispanic/Latino	967 (17.6%)		(19.8%)
	Hispanic/Latino	885 (16.1%)		909 (16.1%)
	Black	462 (8.4%)		455 (8.1%)
	American Indian/Alaskan Native	40 (0.7%)		50 (0.9%)
		20 (0.4%)		13 (0.2%)
				655 (11.6%)
Tobacco Use	Yes.	1,522 (27.7%)		4,994
	No (Never Smoked)	3,972 (72.3%)		(88.4%)
				4,504
Alcohol	Yes	4,466 (81.3%)		(79.7%)
	No	956 (17.4%)		946 (16.7%)
				817 (14.5%)
Overweight	Yes	798 (14.5%)		4,466
	No	4,386 (79.8%)		(79.1%)
				843 (14.9%)
Obese	Yes	728 (13.3%)		4,440
	No	4,456 (81.1%)		(78.6%)

### Testing Assumptions

I used chi-square and logistic regression to address the research questions.

Logistic regression is robust to violations of linearity. That is, there does not have to be a linear relationship amongst the dependent and independent variables (Kleinbaum, Dietz,

Gail, Klien, & Klein, 2002). However, logistic regression does require the following assumptions to be met: no multicollinearity among the independent variables and linearity of independent variables and log odds (Kleinbaum et al., 2020). Each independent category is independent and mutually exclusive, therefore, the assumption of independence of observations has been met. To test for multicollinearity, the variance inflation factor (VIF) was tested. A value of 10 or more suggests violations of multicollinearity (see Cohen et al., 2003). For the before Tobacco 21 Law sample (year 2015), the VIF values ranged from 1.001 to 1.060. For the after Tobacco 21 Law sample (year 2017), the VIF values ranged from 1.002 to 1.051. The assumptions of multicollinearity were met. Last, chi-square analyses require each cell to have 5 or more cases and this assumption was met.

## **Results**

### **Research Question 1: Tobacco 21 Law and Youth Tobacco Usage Rates**

To compare differences in youth tobacco usage rates across the two samples (before Tobacco 21 Law and after Tobacco 21 Law) I utilized chi-square analysis and logistic regression. With chi-square analysis I found significant differences for Tobacco use,  $\chi^2(1) = 459.713, p < .001$ . Post-hoc analyses revealed the proportion of participants in the Yes category were significantly larger for the before Tobacco 21 Law group, in comparison to the after Tobacco 21 Law group. In addition, the proportion of participants in the No category were significantly lower for the before Tobacco 21 Law, in comparison to the after Tobacco 21 Law. Table 5 summarizes the chi-square proportion comparison.

**Table 5***Youth Tobacco use Before and After the Tobacco 21 Law: Chi-square Analysis*

		Tobacco 21 Law		
		Before	After	
Tobacco Use	Yes	Count	1,522	655
		Expected Count	1,073.4	1,103.6
		%	69.9%	30.1%
	No	Count	3,972	4,994
		Expected Count	4,420.6	4,545.6
		%	44.3%	55.7%

I utilized binary logistic regression to identify whether the law may be associated with youth Tobacco Use (dependent variable), a binary logistic regression was conducted using Tobacco 21 Law (before, after) as the predictor. The model was statistically significant,  $\chi^2(1) = 469.639, p < .001$ , and the predictor accounted for 6.6% of the variance in the outcome variable (Pseudo  $R^2 = .006$ ).

The results indicated that participants before the Tobacco 21 Laws were 2.92 times more likely to report “Yes” for Tobacco Use, in comparison to the after the Tobacco 21 Laws participants (see Table 6).



**Table 6**

*Binary Logistic Regression Analysis for Tobacco 21 Law Predicting Youth Tobacco Use*

Predictor	Category	B	SE	OR (e <sup>B</sup> )	95% CI	
					Upper	Lower
Tobacco 21 Law	Before	1.072	.051	.2.922***	2.642	3.231
Constant		-2.031	.042	.131***		
$\chi^2$		469.639***				
Pseudo R <sup>2</sup>		.006				

*Note. The reference category for Tobacco 21 Law is “after”.*

*Note. e<sup>B</sup> = exponentiated B, or odds ratio.*

*Note. \*p < .05. \*\*p < .01. \*\*\*p < .001*

### **Research Question 2: Factors Associated with Before the Tobacco 21 Law**

To identify whether the before Tobacco 21 Law may be associated with youth Tobacco Use (dependent variable), I conducted binary logistic regression using Gender (male, female), race (White, American Indian/Alaskan Native, Asian, Black, Native Hawaiian/Other Pacific Islander, Hispanic/Latino, Multiracial -Hispanic/Latino), Obese (Yes, No), Overweight (Yes, No), and Alcohol Use (Yes, No) as the predictors. The model was statistically significant,  $\chi^2(10) = 484.616$ ,  $p < .001$ , and the predictor accounted for 13.0% of the variance in the outcome variable (Pseudo  $R^2 = .130$ ).

The results indicated that, before the Tobacco 21 Law, race, overweight status, and alcohol use were significant predictors of tobacco use. Specifically, participants who identified as American Indian or Alaskan Native were 43.8% more likely to report “Yes”

for Tobacco Use, in comparison to White participants. In addition, participants who identified as Native Hawaiian or Other Pacific Islander were 49.6% more likely to report “Yes” for Tobacco Use, in comparison to White participants. Similarly, participants who identified as Multiracial – Hispanic/Latino were 49.2% more likely to report “Yes” for Tobacco Use, in comparison to White participants. In contrast, participants who identified as Asian were 30.5% less likely to report “Yes” for Tobacco Use, in comparison to White participants. Black and Hispanic or Latino participants did not differ significantly in reported Tobacco Use, in comparison to White participants ( $ps > .05$ ). Participants who were not overweight were 25.7% more likely to report Tobacco Use, in comparison to participants who were overweight. Whereas participants who reported not using alcohol were 76.0% less likely to report Tobacco use, in comparison to participants who use alcohol. Gender and obese status were not significant predictors in the model (see Table 7).

**Table 7***Binary Logistic Regression Analysis for Prior to Tobacco 21 Law Predicting Youth**Tobacco Use*

Predictor	Categories	B	SE	OR (e <sup>B</sup> )	95% CI	
					Upper	Lower
Gender	Female	.006	.067	1.006	.882	1.146
Race	American Indian/Alaskan Native	.364			1.177	1.758
	Asian	-.364	.102	1.438***	.155	.866
	Black	.488	.112	.695***	.777	3.415
	Native Hawaiian/Other	.403	.378	1.629	1.199	1.866
	Pacific Islander	.708	.113	1.496***	.768	5.366
	Hispanic/Latino	.400	.496	2.031	1.141	1.953
	Multiracial -Hispanic/Latino		.137	1.492**		
Obese	No	.111	.097	1.118	.925	1.351
Over weight	No	.229	.090	1.257*	1.053	1.500
Alcohol Use	No	- 1.426	.078	.240***	.206	.280
Cons- tant		-.036	.114	.964		
$\chi^2$				484.616***		
Pseudo R <sup>2</sup>				0.130		

*Note. The reference category for gender is "male", for race is "White", and for Obese, Overweight, and Alcohol Use is "yes".*

*Note. e<sup>B</sup> = exponentiated B, or odds ratio.*

*Note. \*p < .05. \*\*p < .01. \*\*\*p < .001*

**Research Question 3: Factors Associated with After the Tobacco 21 Law**

To identify whether the after the Tobacco 21 Law may be associated with youth Tobacco Use (dependent variable), a binary logistic regression was conducted using Gender (male, female), race (White, American Indian/Alaskan Native, Asian, Black, Native Hawaiian/Other Pacific Islander, Hispanic/Latino, Multiracial -Hispanic/Latino), Obese (Yes, No), Overweight (Yes, No), and Alcohol Use (Yes, No) as the predictors. The model was statistically significant,  $\chi^2(10) = 589.342, p < .001$ , and the predictor accounted for 22.4% of the variance in the outcome variable (Pseudo  $R^2 = .224$ ).

The results indicated that, after the Tobacco 21 Law, gender, race, obese status, and alcohol use were significant predictors of Tobacco Use. For gender, females were 23.5% less likely to report Tobacco Use, in comparison to males.

For race, participants who identified as American Indian or Alaskan Native were 87.9% more likely to report “Yes” for Tobacco Use, in comparison to White participants. In addition, participants who identified as Black were 2.724 times more likely to report “Yes” for Tobacco Use, in comparison to White participants. In addition, participants who identified as Native Hawaiian or Other Pacific Islander were 44.6% more likely to report “Yes” for Tobacco Use, in comparison to White participants. Asian, Hispanic or Latino, and Multiracial – Hispanic/Latino participants did not differ significantly in reported Tobacco Use, in comparison to White participants ( $ps > .05$ ).

Participants who were not obese were 32.4% more likely to report Tobacco Use, in comparison to participants who were obese. Whereas participants who reported not using alcohol were 58.0% less likely to report Tobacco use, in comparison to participants

who use alcohol. Overweight status was not a significant predictor in the model (see Table 8).

**Table 8**

*Binary Logistic Regression Analysis for After the Tobacco 21 Law Predicting Youth*

*Tobacco Use*

Predictor	Categories	B	SE	OR (e <sup>B</sup> )	95% CI	
					Upper	Lower
Gender	Female	-.268	.101	.765**	.627	.933
Race	American Indian/Alaskan Native	.631	.163	1.879***	1.366	2.585
	Asian	1.002	.180	1.054	1.043	7.114
	Black	.369	.490	2.724*	1.019	2.051
	Native Hawaiian/Other Pacific Islander	.306	.178	1.446*	.249	7.408
	Hispanic/Latino	-.074	.866	1.358	.574	1.504
	Multiracial -Hispanic/Latino		.246	.929		
	Obese	No	.281	.129	1.324*	1.028
Overweight	No	.168	.137	1.183	.905	1.548
Alcohol Use	No	=-2.273	.100	.103***	.085	.125
Constant		-.868	.162	.420***		
$\chi^2$				589.342***		
Pseudo R <sup>2</sup>				0.224		

*Note. The reference category for gender is “male”, for race is “White”, and for Obese, Overweight, and Alcohol Use is “yes”.*

*Note. e<sup>B</sup> = exponentiated B, or odds ratio.*

*Note. \*p < .05. \*\*p < .01. \*\*\*p < .001*

## Summary

In this chapter, the three research hypotheses designed to address the central hypothesis of this study were explored, which was that the Tobacco 21 Law would influence youth tobacco use in the state of Hawaii. Findings revealed that reported tobacco use was significantly greater before the Tobacco 21 Law, in comparison to after the Tobacco 21 Law. For before the Tobacco 21 Law, race, overweight status, and alcohol use were significant predictors of Tobacco Use. For after the Tobacco 21 Law, gender, race, obese status, and alcohol use were significant predictors of Tobacco Use.

In chapter four I summarize and interpret findings. In addition, conclusions will be drawn from this research and recommendations for practice and recommendations for research will be discussed. In section four I will also discuss study limitations and summarize overall findings.

#### Section 4: Application to Professional Practice and Implications for Social Change

##### **Discussion**

The Tobacco 21 Law prohibits the sale of tobacco containing products, including electronic cigarettes, to people under the age of 21 (Winickoff, 2018). The purpose of this study was to examine the influence of the Tobacco 21 law on the rates of youth tobacco use in the state of Hawaii. Specifically, I compared youth tobacco usage rates before the passage of the statewide law in 2015 to youth tobacco usage rates in 2017 one year after passing the statewide law. In this study I also evaluated the relationship between the Tobacco 21 Law and gender (male/female), race, obesity (yes/no), overweight (yes/no), and alcohol use (yes/no) on youth tobacco usage rates as well as the different races of youth who participated in the YRBS.

##### **Summary of Findings**

Findings revealed that reported tobacco use was significantly greater before the Tobacco 21 Law, in comparison to after the Tobacco 21 Law. For before the Tobacco 21 Law, race, overweight status, and alcohol use were significant predictors of tobacco use. Specifically, American Indian or Alaskan Native, Native Hawaiian or Other Pacific Islander, and Multiracial – Hispanic/Latino participants were significantly more likely to use tobacco, in comparison to White participants. In contrast, Asian participants were significantly less likely to use tobacco, in comparison to White participants. Black and Hispanic or Latino participants did not differ significantly in reported tobacco use, in comparison to White participants before the Tobacco 21 Law. Participants who were not overweight were more likely to report tobacco use, in comparison to participants who

were overweight. Whereas participants who reported not using alcohol were less likely to report Tobacco use, in comparison to participants who use alcohol. Gender and obese status were not significant predictors of tobacco use prior to the Tobacco 21 Law.

After the Tobacco 21 Law, gender, race, obese status, and alcohol use were significant predictors of Tobacco Use. Specifically, female youth were less likely to report tobacco use, in comparison to male youth. For race, American Indian or Alaskan Native, Black or African American, and Native Hawaiian or Other Pacific Islander were more likely to use tobacco, in comparison to White participants. Asian, Hispanic or Latino, and Multiracial – Hispanic/Latino participants did not differ significantly in reported tobacco use, in comparison to White participants. Participants who were not obese were more likely to report tobacco use, in comparison to participants who were obese. Participants who reported not using alcohol were less likely to report tobacco use, in comparison to participants who use alcohol. Overweight status was not a significant predictor of tobacco use after the Tobacco 21 Law.

### **Interpretation of the Findings**

Understanding whether the Tobacco 21 Law, which prohibits the sale of tobacco containing products to people under the age of 21 had a significant influence on youth tobacco use was the primary focus of the present study. Findings revealed that reported Tobacco use was significantly greater before the Tobacco 21 Law, in comparison to after the Tobacco 21 Law. Specifically, youth Tobacco use was reported at a rate 2.92 times higher before the Tobacco 21 Law, in comparison to after the Tobacco 21 Law. These findings are in line with prior research on the reduction in youth tobacco use after the



initiation of the Tobacco 21 Law (Boyle et al., 2017; Macinko & Silver, 2018; Schneider et al., 2016). Prior research has found that the Tobacco 21 Law reduced tobacco use over 40% in certain jurisdictions (Morain & Malek, 2017). In the present study, these findings were replicated in Hawaii through youth reporting tobacco use at a rate of 39.80% lower after the Tobacco 21 Law was passed.

However, little was known about the effects of tobacco use and the Tobacco 21 Law on specific demographics. In this study I explored differences in tobacco use before and after the Tobacco 21 Law based on gender, race, overweight status, obese status, and alcohol use of youths.

For before the Tobacco 21 Law, race, overweight status, and alcohol use were significant predictors of tobacco use. Whereas, after the Tobacco 21 Law, gender, race, obese status, and alcohol use were significant predictors of tobacco use. Gender had an effect only after the Tobacco 21 Law. That is, female youth were less likely to report tobacco use, in comparison to male youth. However, tobacco use for gender did not differ significantly prior to the Tobacco 21 Law. These findings may suggest that the Tobacco 21 Law made a greater difference for reducing tobacco use for female youth after the law was passed, in comparison to male youth.

For race, for before and after the Tobacco 21 Law, American Indian or Alaskan Native and Native Hawaiian or Other Pacific Islander reported higher use of tobacco, in comparison to White. In addition, Black participants reported higher levels of tobacco use after the Tobacco 21 Law. This suggests that the Tobacco 21 Law may not have reduced use for these specific race demographics.

In contrast, Multiracial – Hispanic/Latino were more likely to use tobacco prior to the Tobacco 21 Law and this finding was not significant after the Tobacco 21 Law. This suggests the Tobacco 21 Law may have significantly reduced Multiracial – Hispanic/Latino reported use of tobacco. In addition, Asian participants reported significantly lower use of tobacco prior to the Tobacco 21 Law, in comparison to White participants. However, this difference was not significant after the Tobacco 21 Law, suggesting the gap may have closed for White participants after the Tobacco 21 Law.

For overweight status, prior to the Tobacco 21 Law, participants who were overweight were less likely to use tobacco. However, this finding was not significant after the Tobacco 21 Law. Similarly, participants who were obese after the Tobacco 21 Law were significantly less likely to use tobacco. However, this finding was not significant prior to the Tobacco 21 Law. Overall, it seems that being overweight or obese may reduce the likelihood of using tobacco. Unfortunately, the present findings do not show a consistent pattern to suggest that the Tobacco 21 Law had an impact on reduction of tobacco use on this demographic.

Last, alcohol use had a significant impact on tobacco use before and after the Tobacco 21 Law. Specifically, individuals who used alcohol were 42% more likely to use tobacco after the Tobacco 21 Law. Therefore, it seems that individuals who can access alcohol have access to individuals over the age of 21. Although it is suggested that youth under 21 would be less likely to have friends 21 years of age or older (Morain & Malek, 2017), it seems that participants who have access to alcohol are more likely to use tobacco, regardless of the new law. In fact, the percentage of individuals who drank

and used tobacco increased 18% from before to after the law was passed. This suggests that alcohol is a significant factor for tobacco use.

### **Limitations and Recommendations for Future Research**

This study had a few limitations that could be addressed in future research. First, the present study only evaluated participants in the state of Hawaii. Given that all the states in the United States were not included in the present study, this limits the generalizability of the findings to the greater population of the United States.

Second, the results are based on 1 year of data. This also limits understanding the long-term effects of the Tobacco 21 Law on youth tobacco use. To fully understand the long-term effects of the Tobacco 21 Law on youth tobacco use, a follow-up study should assess tobacco use five years after to understand whether youth will find other avenues to obtain tobacco once the age limit is raised.

Third, the use of secondary data across two survey administrations makes it difficult to compare and make sound conclusions upon the differences in tobacco use. That is, use of longitudinal research to understand whether the Tobacco 21 Law actually reduced tobacco use by evaluating individuals who never smoked, individuals who smoked and stopped after the Tobacco 21 Law, and individuals who continued smoking would be beneficial to understand the actual effects of reducing smoking by increasing the age requirements. Future research should assess longitudinal data to understand how the Tobacco 21 Law influences the same youth over the course of several years.

Fourth, secondary survey data limits the understanding of specific reasons why changes were made to tobacco use across various samples. A mixed-methodological

approach that asks youth to explain why they never have smoked, smoked but stopped, or continue to smoke would assist in our understanding of the effects of the Tobacco 21 Law by utilizing a deductive qualitative approach with the Tobacco 21 Law as a main theme.

Several other possible limitations include that other covariates such as grade in school, household income, and marijuana use could have been evaluated. Ecological fallacy could also limit the interpretation of the research findings. Lastly, even though overweight and obesity were not statistically significant for tobacco use, these two covariates could have a shared gradient.

### **Implications for Practice and Social Change**

Increasing the legal age to purchase tobacco was found to significantly reduce the rates of reported youth tobacco use in Hawaii., as well as several other states (Boyle et al., 2017; Macinko & Silver, 2018; Schneider et al., 2016). Overall, the present findings suggest the Tobacco 21 Law significantly decreased youth tobacco use by 39.80% in one year. During the interim of this research the Tobacco 21 Law was passed nationwide within the United States but the findings could have significant implications for policy makers in other countries, such as Canada, Germany, Australia, and the United Kingdom, to increase the legal smoking age to reduce the rate of tobacco use among the youth population.

Through a deeper analysis of the sample, specific demographics seemed to benefit from the law more than others. That is, female youth reported a significant decrease in tobacco use after the Tobacco 21 Law. However, male youth did not. Therefore,

interventions targeted towards assisting male youth in understanding the ramifications of smoking may help reduce youth male tobacco use above and beyond the passing of the law alone.

Similarly, the Tobacco 21 Law did not influence alcohol use and alcohol use is a significant factor in youth use of tobacco. In fact, alcohol use with reported tobacco use increased after the law was passed. Therefore, given that alcohol use has a significant association with tobacco use, an intervention or program for youth to decrease the use of alcohol and tobacco use may further reduce their use of tobacco.

Last, certain racial demographics reported similar use of tobacco before and after the Tobacco 21 Law. Namely, American Indian or Alaskan Native, Native Hawaiian or Other Pacific Islander, Black or African American did not report lower levels of tobacco use after the Tobacco 21 Law. Further investigation as well as educational programs to ensure tobacco is being limited to all youth is necessary to ensure a reduction in tobacco use.

### **Conclusion**

Overall, the present study made several important contributions to research for the effects of the Tobacco 21 Law on youth tobacco use. Findings revealed that self-reported youth tobacco use decreased significantly in Hawaii after the Tobacco 21 Law was passed. In addition, the Tobacco 21 Law reduced youth tobacco use for specific demographics, such as females, Multiracial – Hispanic/Latino, and White individuals. However, the Tobacco 21 Law had less of an effect on American Indian or Alaskan

Native, Native Hawaiian or Other Pacific Islander, Black or African American, and alcohol users.

The present findings provide important implications for future research. Specifically, future research should aim to understand why certain demographics were not influenced by the Tobacco 21 Law and to provide additional interventions for those who were not influenced by the Tobacco 21 Law.

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