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Keith Knapp, PhD, Committee Chair

Sarah Wackerbarth PhD, Director of Graduate Studies

**Assessing the Impact of Raising the National Minimum Purchase Age of
Tobacco to 21 on Tobacco Use in Youth**

CAPSTONE PROJECT PAPER

A paper submitted in partial fulfillment of the
Requirements for the degree of
Master of Public Health in the
University of Kentucky College of Public Health

By

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Final Examination:

Lexington, Kentucky

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Abstract

Introduction: Tobacco use is the number one cause of preventable death in the United States with roughly 500,000 premature deaths a year and 3,200 youth smoking their first cigarette daily. On December 20, 2019, President Trump signed legislation to raise the federal minimum age of sale of tobacco products from 18 to 21 years, effective immediately. Prior to this recent regulation, over half of the US population was enforcing this age restriction. The objective of this research is to investigate the impact of tobacco 21 laws on tobacco use and project the national tobacco impact by using the state experiences with tobacco 21 laws.

Methods: The data was obtained from four separate state health departments in Hawaii, California, Oregon, and Maine. Data were taken from two surveys, one that was before the implementation of a Tobacco 21 statewide law, and the other was taken a full year after the regulation was in effect. The data is specifically focusing on youth tobacco use, and the information from these sources were from a youth health survey administered to high schoolers grades 9-12. With these answers, the researcher was able to compare the results from the two surveys within each state to determine the change and the specifics of those changes.

Results: In all four states, there is roughly a 50/50 split with males and females, with the same majority of ethnic groups. Males are mostly smoking. In all four states, cigarette, cigar, and smokeless tobacco use decreased, while e-cigarette use increased. Combined tobacco use varied with an increase in Hawaii & Oregon, and a decrease in California and Maine. There are more tobacco users in rural areas and fewer users after Tobacco 21 implementation.

Conclusion: The states in this paper have laid down the groundwork for the states that are following with similar policies and likewise the federal legislation enacted in December 2019. The goal was to observe the change of tobacco use in high school students, types of tobacco, and

urban/rural use. The states' experiences were also used to project what the national impact would be. The data provides information on where the policies have been successful and where they have not and need to be further improved. This project data is evidence that Tobacco 21 is effective and a crucial part of public health.

Keywords: Tobacco 21, youth health survey, high school, policy

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Introduction

Tobacco use is the number one cause of preventable death in the United States with roughly 500,000 premature deaths a year and 3,200 youth smoking their first cigarette daily (Jamal 2017). For several years, numerous organizations have been lobbying and showing aggressive support for legislation to raise the purchasing age of tobacco to 21. Data has shown that 95% of adult tobacco users will start before the age of 21, and youth often have acquaintances who are seniors in high school purchasing products for their younger friends (Freidman 2019). Although these efforts surfaced during the late 1990s, only in the last seven years has this issue significantly advanced in the United States.

In 2013, New York City was the first large city and in 2016, Hawaii was the first state to enact a Tobacco 21 law. Several cities and states have followed the example of these governments and have proven to have significant health changes in their youth (Jamal 2017). Efforts to make tobacco 21 legislation nationwide had been pressed and debated but was made difficult to pass due to push back from several sources. However, on December 20, 2019, President Trump signed legislation to raise the federal minimum age of sale of tobacco products from 18 to 21 years, effective immediately. Prior to this recent regulation, over half of the US population was enforcing this age restriction; going forward, the non-tobacco 21 states will have a new set of rules to follow with no argument.

The objective of this research is to investigate the impact of tobacco 21 laws on tobacco use and project the national tobacco impact by using the state experiences with tobacco 21 laws. These experiences in Hawaii, California, Oregon, and Maine will be included because of they were among the first states in the nation with this type of regulation; consequently, they have produced enough data to compare the effects before and after the law went into effect. This is an

important issue because of the potential to prevent poor health outcomes (cardiovascular risks and various cancers), financial and medical savings, and the potential to create future generations whose tobacco use is the least in history. Reducing youth access to tobacco products is a key tool in reducing initial tobacco use and increasing the overall health of the individual.

Literature Review

Policy Development

In order to understand Tobacco 21, there should be an understanding to how this legislation has been successfully developed, passed and implemented. Tobacco 21 laws have been slowly developed and utilized in the United States (US) to largely improve the health of youth and have potential impact to prevent future smokers from starting. Thus, initial research suggests these regulations would help to reduce high school smoking rates, decrease tobacco initiation among those 15-17 years old by 25% and decrease adult smoking by 12% (Dobbs 2019). Support is broad in the US and varies on your location with studies showing about 50%-70% of current smokers approving of these policies along with African Americans and former smokers (Dobbs 2019).

A concern is the enforcement of and compliance of tobacco 21 policies varied from city to city and from state to state. These include, but are not limited to: retailers that disregard the law, lack of retailer education, or language on certain components. The language of these types of current policies has not been studied and a foundational first step is a recommended need (Dobbs 2019). Tools and trainings have now been developed to measure strategies used by cities and states which include retail training and public-school tobacco policies. Proper use of the policies found to effectively reduce youth access include: compliance checks in different locations, monetary penalties, suspending/revoking tobacco retail licenses, and education of

retailers (Dobbs 2019). A document review was performed which is a structured qualitative research methodology used to examine documents such as the policies passed by the local and state governments (Dobbs 2019). An assessment tool was developed to examine these policies which included a Tobacco 21 summit, review of literature and established policies, a working document, and revision and testing (Dobbs 2019). States and localities were then observed and studied based on their current tobacco regulations. The findings included thought-provoking results in the following categories: rationale, comprehensive tobacco definition, age verification, enforcement, signage and education, and finally, negative policy language (Dobbs 2019). Having a tool like this to measure a policy and capture certain aspects is a great way for future regulations to observe what needs to remain or be updated.

Community Evidence:

Using data from Needham, Massachusetts (the first town in the US to enact Tobacco 21), there is evidence that suggests a reduction in youth access and initiation (Kessel 2016). The MetroWest Adolescent Health Survey (MWAHS) recorded over 16,000 students (roughly 90% of participation) every other year over a span of six years in Needham and 16 surrounding communities that did not enact a Tobacco 21 law. During the time of the survey, smoking decreased in Needham youth from 13% to 7% compared to the 16 surrounding communities which reduced from 15% to 12% (Kessel 2016). The specific demographic of this group in decline included both genders, Caucasian and non-Caucasian, and grades 10, 11, & 12 (Kessel 2016). Finally, cigarette purchases in youth smokers declined significantly more in Needham than in the surrounding communities (Kessel 2016). This study is merely a small piece of evidence to show that there is a positive effect on youth who are inclined to use tobacco products. There are several studies around the country similar to this that would provide the same

result. Raising the minimum purchase age to 21 for tobacco contributes to a greater decline in youth use.

High School Use:

The youth of the country are a vulnerable population that are large targets for tobacco companies. The students measured were high school students (grades 9-12) during the years of 2011 through 2016. The use of tobacco has been sporadic and has decreased from 2015 to 2016. It appears that during this period that most products declined among high school students and that only e-cigarettes declined in middle school students (Jamal 2017).

In 2016, there were an estimated 3.9 million US middle and high school students using tobacco products, with 1.8 million currently using >2 tobacco products (this would include those who reported they used products and did not[estimated]) (Jamal 2017). Tobacco prevention and control strategies at the national, state, and local levels are likely to have contributed to the reduction of certain products. One limitation mentioned is that this data comes from public and private schools, this leaves home school, drop-outs or detention center youths out of the picture (Jamal 2017).

This group is also interesting because of the impact of peers and of social groups. Raising the purchase age to 21 has now made tobacco use in high school out of the picture. This will in turn reduce the sources in which younger individuals can attain tobacco. The breakdown of students is a good way to indicate what behaviors that cohorts of that certain age are performing. This could lead to better intervention methods for specific age groups.

Types of Tobacco:

Use of these products continues to cause many illnesses and deaths across the United States. Youth are a particular target because nearly all tobacco product use begins during

adolescence/young adulthood (Gentzke 2019). Cigarette smoking has steadily declined over the past two decades; however, recent changes in the tobacco landscape with the introduction of electronic cigarettes (e-cigarettes) has driven tobacco use up by youths (Gentzke 2019). This product was first introduced to assist in adults attempting to quit smoking by reducing the amount of tobacco consumed. The National Youth Tobacco Survey (NYTS) is an annual cross-sectional, voluntary, school-based, self-administered, pencil-and-paper survey of US middle school (grades 6-8) and high school (grades 9-12) students (Gentzke 2019). These surveys were recorded and generated a national representative sample of US students. The students were asked about seven of the most popular tobacco products which included: cigarettes, cigars (cigars, little cigars, and cigarillos), smokeless tobacco, e-cigarettes, hookahs, pipe tobacco, and bidis. In the survey, questions were asked about daily use, amount of products used and the types used.

For 2018, it was recorded that 27.1% of high school students reported using any tobacco product; additionally, e-cigarettes were the most commonly used tobacco product among high school students at 20.8% followed by cigarettes at 8.1% (Gentzke 2019). With a perspective into use by race, e-cigarettes were the most commonly used tobacco product among whites at 26.8% and Hispanics at 14.8%; cigars were the most commonly used tobacco product among black high school students 9.2% (Gentzke 2019). In 2018, frequent use among current product users in high school was 37.7% for smokeless tobacco, 27.7% for e-cigarettes, 23.1% for cigarettes, etc. (Gentzke 2019). During 2017–2018, frequent e-cigarette use increased significantly by 38.5% among current e-cigarette users from 20.0% to 27.7% with no significant change in frequent use for other tobacco products (Gentzke 2019).

In summary, for 2018, approximately one in four U.S. high school students reported current use of any tobacco product; accordingly, both high school and middle school students,

current use of e-cigarettes has increased (Gentzke 2019). E-cigarettes have been the most commonly used tobacco product among US youths since 2015 and is slowly increasing. Flavored products are attractive to youth and are willing to partake in these activities if their counterparts are willing to share.

Urban vs. Rural:

In recent years, the United States has been increasing their focus on rural America and their influence on the country. Several resources are limited to them which limits certain aspects of their lives, including education and medical care. Concerning tobacco use, rural areas in the US have the highest cigarette and smokeless tobacco use rates in the country (Roberts 2017). Additionally, the prevalence of daily cigarette use among rural residents was 16.3%, whereas the prevalence among urban residents was 12.3% (Roberts 2017). National trends from 2007 to 2014 has shown that although the prevalence of cigarette smoking is declining in the United States, the decline is more pronounced in urban than in rural populations (Roberts 2017). Tobacco use prevalence is particularly high among rural men, and the largest differences appear in the South region of the country (Roberts 2017). These findings show that there seem to be unique differences between urban and rural populations and their use of cigarettes and smokeless tobacco.

Very little emphasis has been placed on tobacco use in rural areas while research has been primarily focused on national trends. An example of this is in one study that found daily tobacco users in Appalachia showed one third of male participants used smokeless tobacco (Roberts 2017). A Population Assessment of Tobacco and Health (PATH) Study was used to obtain information on US youth and adults and was launched by the National Institutes of Health and the Food and Drug Administration. It received information on urban and rural populations as

well as their tobacco use. The results indicated that the prevalence of any daily cigarette use was 18.3% in rural areas and 13.5% in urban areas; similarly, smokeless tobacco use was 3 times more prevalent in rural than urban areas (6.3% vs 2.1%). Traditional, dual, or polytobacco (the use of two or more tobacco products) use was also more prevalent in rural areas (Roberts 2017). The study also indicated there were no significant urban–rural differences in use of menthol cigarettes, e-cigarettes, cigars, or pipes (Roberts 2017). At that time, e-cigarette numbers were similar to both areas, however, there is concern that the number could rise if further research is not performed. Ultimately, understanding the urban and rural differences in use of tobacco products provides a clearer picture of health disparities in the US.

Conclusion:

Tobacco 21 regulations have made headway in the United States and the new regulation signed in December 2019 was the final piece to raising the minimum purchase age. Plenty of evidence has been indicated that this piece of legislation will succeed and attain a better health outcome for our youth and for future generations (Friedman 2019). This total examination will provide the proper research and trends showing that the policy works and is lowering youth tobacco use. Observing the types of tobacco used, the location of users, and the use in school can give great information to help intervene and potentially predict upcoming trends and issues. The future is the remaining gap. Through the predictions of the statistics and data gathered through tobacco 21 states, a good prediction can be made about how the United States will be affected. Analyzing the data can fill in the gap and show the impact of a health policy.

Methods

This research design was chosen so that the information gathered could be used to better understand the specific results and impacts from each state. The data was obtained from four

separate state health departments in Hawaii, California, Oregon, and Maine. Data were taken for all four states from two surveys, one that was before the implementation of a Tobacco 21 statewide law, and the other was taken a full year after the regulation was in effect. The gathered data was specifically focused on youth tobacco use, but there may have been additional information included from each data source. The information from these sources were from a youth health survey administered to high schoolers grades 9-12. Depending on the state, some grades may not have taken the survey and the questions might have been worded differently because of the manner in which the survey was administered. These answers were also hoped to have been answered honestly, with anonymous answers being taken to assure no backlash would return to the student. These questions may have been different and worded similarly, but nonetheless gathered similar categorical results. The questions asked were created to assess the demographic and tobacco use data among youth in high school. With these answers, the researcher was able to compare the results from the two surveys within each state to determine the change and the specifics of those changes; therefore, there would be determination if the Tobacco 21 policy is effective in the state and an analysis would then attempt to determine a nationwide trend.

These specific states were chosen based on the amount of time that a Tobacco 21 policy has been in effect. The in-effect years ranging from 2016-2018, thus having 20-50 months, to date, of full statewide implementation. These common trends and impacts were analyzed to evaluate each implementation process in the state and how each one compares to the other.

Results

The information in this section was obtained through high school survey data collected and analysis of the quantitative data provided by each specific state public health department.

The answers of the surveys given to the students were used to provide insight into the implementation process of the Tobacco 21 law in each respective state. The specific information focused on the previously mentioned four states and were divided into three categories: Tobacco use in High School Students, Types of Tobacco use in High School Students, and Urban vs Rural.

Hawaii:

The Tobacco 21 law which raised the minimum purchasing age of tobacco has been in effect in Hawaii since January 1, 2016 and was the first in the nation to have the implementation statewide. Legislation was passed on June of 2015, and the process began with informing and educating retailers and high school about the new regulation. The survey given to the students had 85 questions in 2015, and 99 questions in the 2017 survey respectfully. Both surveys were a self-administered survey format and employed a two-stage cluster design to produce a representative sample of students in high school (grades 9-12). The first-stage sampling frame consisted of all public schools containing any grades 9-12. Schools were selected with probability proportional to school enrollment size: 26 schools were selected for each sampling frame. The second sampling stage consisted of systematic equal probability sampling (with a random start) of classes from each school that participated in the survey. All students in the selected classes were eligible to participate in the survey. Passive parental consent was required for each student participating in the survey. The questions were divided into categories which included: background information, specific Hawaii questions, use of certain tobacco products, advertisements, exposure to other tobacco smoke, personal thoughts on tobacco, & home and community.

Tobacco Use in High School Students

In 2015, prior to the legislation put into effect, the total number of high school students surveyed in the state was 1,911, with 50.1% being male and 49.9% being female. The four largest ethnic groups included: 25.5% Filipino, 17.2% Native Hawaiian, 15.3% more than one group, and 12.6% White. The following individual grades were represented: 9th at 29.0%, 10th at 24.9%, 11th at 22.8%, and 12th at 23.3%. The high school use by sex included: 8.1% of males and 6.6% of females. The means of obtaining the tobacco products were: 17.4% purchasing the products themselves, and 30.2% having someone else purchase the product. Finally, when asked about cessation, the overall high school answer within 30 days was 5.7%.

In 2017, after the legislation was in effect, the total number of high school students surveyed in the state was 1,926, with 49.6 % being male and 50.4% being female. The four largest ethnic groups included: 24.0% Filipino, 17.3% more than one group, 16.3% Native Hawaiian, and 12.5% White. The following individual grades were represented: 9th at 28.4%, 10th at 25.4%, 11th at 23.8%, and 12th at 22.4%. The number for both sexes dropped to: 6.2% for males and 5.9% for females. The means of obtaining dropped to: 15.2% purchasing the products themselves, and 29.2% having someone else purchase the product. Finally, when asked about cessation, the overall high school answer within 30 days rose to 13.8%.

Types of Tobacco Use in High School Students

The five indicators assessed in this survey include the following: cigarettes, e-cigarettes, cigars, smokeless tobacco, and any form of tobacco. In 2015, prior to Tobacco 21 legislation going into effect, the product use was the following among high school tobacco users: 28.3% for

cigarettes, 22.2% for e-cigarettes, 10.3% for cigars, 6.0% for smokeless tobacco, and any form of tobacco was at 30.7%.

In 2017, after the Tobacco 21 legislation went into effect, the product use became the following among high school tobacco users: 20.8% for cigarettes, 39.4% for e-cigarettes, 8.7% for cigars, 4.9% for smokeless tobacco, and any form of tobacco was at 43.1%. From these results, it seems that cigarette, cigar, and smokeless tobacco use dropped after the legislation was in effect. However, e-cigarette and any form of tobacco use were higher after implementation.

Urban vs Rural

Hawaii is a different state to view ruralism and urbanism. The state has only one school district and has a total of 126 high schools: 79 of the schools being public and 47 being private. There are only 5 counties in the entire state: Honolulu, Hawaii, Kauai, Kalawao, and Maui which make up the big islands. According to the US Census Bureau, 91.9 percent of the state's population is Urban, while 8.1 percent is rural. That being said, one could claim that the state is urban; however, it would be difficult to label the entire school system as urban based off the singular school system.

California:

The Tobacco 21 law which raised the minimum purchasing age of tobacco has been in effect in effect in California since June 9, 2016 and was the second in the nation to have the implementation statewide. Legislation was passed on May of 2016, and the process began with informing and educating retailers and high school about the new regulation. Participating schools were encouraged to have all students in a grade take the survey. When this was not possible (23% of schools), classrooms within a grade were randomly sampled for participation. Thus, this survey utilized a two-stage sampling in which stage 1 was the random sampling of schools

within regions and stage 2 was the random sampling of classrooms within schools. For the 2015-2016 survey, the state was divided into 12 regions, which were the same as those that have been used for the California Tobacco Survey of adults. In the 2017-18 survey, the number of regions was increased from 12 to 22 to provide greater sensitivity to regional differences, while ensuring accurate statewide representation.

Sampling used the probability proportional to size (PPS) method and stratified by region with oversampling of less densely populated regions, African American students, and schools that received Tobacco Use Prevention Education program funding. Data are weighted according to procedures described in the technical report cited above and estimates include 95% confidence intervals. The 2015-16 CSTS was primarily done online with appropriate skip patterns that decreased the number of questions a respondent needed to answer. The 2017-18 survey was the first time the response option “I prefer not to answer” was included for all questions. Rates of endorsement varied considerably (from 0.0% to 20.9%).

The survey included respondent characteristics, use of various products (including tobacco and e-cigarettes), opinions about cigarettes and e-cigarettes and their relative harmfulness, and exposure to school tobacco prevention programs. The survey assessed students’ susceptibility to using products and their exposure to secondhand smoke and e-cigarette vapor. The current survey also included questions about whether the respondent had been offered certain tobacco products in the last 30 days. The survey contained 134 questions and were made available in English and Spanish.

Tobacco Use in High School Students

In 2015, prior to the legislation put into effect, the total number of high school students surveyed in the state was 41,802, with 49.9% being male and female with 0.2% unidentified. The

four largest ethnic groups included: 53.6% Hispanic, 18.4% White, 12.3% Asian, and 8.6% multiple races. The following individual grades were represented: 10th at 53% and 12th at 47%. The high school use by sex included: 16% of males and 11.2% of females. Students who indicated they received mostly D's and F's were over twice as likely to be current tobacco users as those who received mostly A's and B's (25.1% vs. 10.3%, respectively). Finally, high school students with spending money were more likely than those without to use tobacco and the greater the amount of money, the greater the use. Students with no money had a current tobacco use prevalence of 7.6%, which became 26.4% among students with over \$50 a week.

In 2017, after the legislation was in effect, the total number of high school students surveyed in the state was 129,494, with 46.6% being female and 42.8 % being male, with 10.6% answering neither. The four largest ethnic groups included: 47.6% Hispanic, 18.8% White, 11% Asian, and 8.4% multiple races. The following individual grades were represented: 10th at 54.3% and 12th at 45.7%. The high school use by sex included: 12.2% of males and 11.1% of females. The means of obtaining the cigarettes were: 34.5% having someone else offers the product to me, 23.2% "I ask someone for the product".

Types of Tobacco Use in High School Students

The five indicators assessed in this survey include the following: cigarettes, e-cigarettes, cigars, smokeless tobacco, and any form of tobacco. In 2015, prior to Tobacco 21 legislation going into effect, the product use was the following among the two high school grades in tobacco users: 4.3% for cigarettes, 8.6% for e-cigarettes, 5.9% for cigars, 1.7% for smokeless tobacco, and any form of tobacco was at 13.6%.

In 2017, after the Tobacco 21 legislation went into effect, the product use became the following among high school tobacco users: 2.0% for cigarettes, 10.9% for e-cigarettes, 3% for

cigars, 0.8% for smokeless tobacco, and any form of tobacco was at 12.7%. From these results, it seems that cigarette, cigar, smokeless tobacco, and any form of tobacco use dropped after the legislation was in effect. However, e-cigarette use was higher after implementation.

Urban vs Rural

The state of California to many people may seem very urbanized, however there are several portions of the state that are not as populated and are rural. Both of the original sampling design surveys were not set up for regional analysis and a total of 117 schools were surveyed in '15-'16, and 333 schools were surveyed in '17-'18. Urban classification is reported by a designation that has been used by the U.S. Department of Education to identify schools as located in city, suburban, town, or rural areas.

In the 2015-2016 survey, the findings of the number of students who lived in the city were 14,652, and of those 12.7% were current users of tobacco products. The number of students who lived in suburban areas were 21,562, and of those 13.8% were current users of tobacco products. Finally, the number of students who lived in rural areas and towns were 5,582, and of those 15.1% were current users of tobacco products.

In the 2017-2018 survey, the findings of the number of students who lived in the city were 48,035, and of those 11.6% were current users of tobacco products. The number of students who lived in suburban areas were 71,211, and of those 13.1% were current users of tobacco products. Finally, the number of students who lived in rural areas and towns were 10,191, and of those 13.3% were current users of tobacco products.

This is a good indicator of geographic differences within state with youth tobacco use; additionally, for both surveys, there are more students living in rural areas who use tobacco

products. There was also a decrease in use from survey to survey after the implementation of the state's Tobacco 21 law.

Oregon:

The Tobacco 21 law which raised the minimum purchasing age of tobacco has been in effect in Oregon since January 1, 2018 statewide. Legislation was passed on July of 2017, and the process began with informing and educating retailers and high school about the new regulation. The Oregon Healthy Teens (OHT) Survey was designed to assess a wide range of topics that included demographics, social determinates of health, academic outcomes, school climate, injury prevention, healthy body, sexual health, and substance use. Results for each item do not include the missing answers, or the proportion of students who did not answer a specific question. These missings range from less than 1% to 11% for 11th grade, with the vast majority of questions having fewer than 10% missing. Only 11th graders took the survey so the results will only represent those who are under the legal purchasing age. The schools excluded from this survey were state-run schools/schools with no associated school district, virtual/web-based public charter schools, and alternative schools. High schools within the county are sampled proportional to their size within the county. For some smaller counties, schools are sampled with certainty – meaning that all high schools within the county are selected to obtain a sample size that provides valid county-level estimates (minimum of 50 students at the county level). Statewide, in 2019, 13,420 11th grade questionnaires were submitted; likewise, in 2017, 12,491 11th grade questionnaires were submitted. The 2017 survey contained 164 questions, while the 2019 survey contained 163 questions respectively.

Tobacco Use in High School Students

In 2017, prior to the legislation put into effect, the total number of 11th grade high school students surveyed in the state was 11,895, with 45.6% being male, 48.2% being female, and 6.2% as other. The four largest ethnic groups included: 62.8% White, 25% Hispanic, 3.6% Asian, and 2.2% African American. The 11th grade high school use was 18.9% overall. The means of obtaining the tobacco products were: 49.4% friends 18 or older, and 33.5% friends under 18. Finally, when asked about cessation, the overall 11th grade answer within the past 12 months was 52.8%.

In 2019, after the legislation was in effect, the total number of 11th grade high school students surveyed in the state was 12,834, with 46.2% being male, 47.7% being female, and 6.1% as other. The four largest ethnic groups included: 61.4% White, 26.8% Hispanic, 4.7% Asian, and 2.2% African American. The overall tobacco use rose to 23.1% which is interesting despite the Tobacco 21 policy in place. The means of obtaining tobacco products was: 56.8% friends under 21 and 18.1% friends 21 or older. Finally, when asked about cessation, the overall 11th grade answer within the past 12 months was 54.1%.

Types of Tobacco Use in High School Students

The five indicators assessed in this survey include the following: cigarettes, e-cigarettes, cigars, smokeless tobacco, and any form of tobacco. In 2017, prior to Tobacco 21 legislation going into effect, the product use was the following among 11th grade high schoolers in tobacco users: 7.7% for cigarettes, 12.9% for e-cigarettes, 7.6% for cigars (little and big), 5.6% for smokeless tobacco, and any form of tobacco was at 18.9%.

In 2019, after the Tobacco 21 legislation went into effect, the product use became the following among 11th grade high school tobacco users: 4.9% for cigarettes, 21.4% for e-

cigarettes, 4% for cigars, 2.5% for smokeless tobacco, and any form of tobacco was at 23.1%. From these results, it seems that cigarette, cigar, and smokeless tobacco use dropped after the legislation was in effect. However, e-cigarette and any form of tobacco use was higher after implementation.

Urban vs Rural

Oregon has many aspects of both urban and rural in the state. Portland is the largest city and the city itself is one of the largest in the country. The urban counties of the state total 11 of 36, they are the following: Columbia, Washington, Multnomah, Yamhill, Clackamas, Polk, Marion, Benton, Lane, Deschutes, and Jackson. In the 2017 survey, the number of students who took participated in the urban counties totaled 8,251, and of those, the average tobacco use was 18.4%. The number of students who took participated in the rural counties totaled 3,642, and of those, the average tobacco use was 20.6%.

In the 2019 survey, the findings of the number of youths who lived in the urban counties totaled 686,925, and the average tobacco use of those students was an average of 10%. The number of youths who lived in the rural counties totaled 151,895, and the average tobacco use of those students was an average of 12%. For both surveys, there are more students living in rural areas who use tobacco products; additionally, there is a decrease in use from survey to survey after the implementation of the state's Tobacco 21 law.

Maine:

The Tobacco 21 law which raised the minimum purchasing age of tobacco has been in effect in Maine since July 1, 2018 statewide. Legislation was passed on August of 2017, and the process began with informing and educating retailers and high school about the new regulation. For the high school survey module responses based on fewer than 6 individuals were not shown

in any report. Also, individual reports have not been generated for schools when fewer than 20 students participated. Specifics on the Methodology of this survey for 2017 and 2019 have not yet been released; however, the following methodology information came from the 2015 survey and would assume to be similar to '17 & '19: all high schools were invited to participate, four versions of the survey (Version A, Version B, Version C, Version D), 63 core questions were included in all four versions of the survey and provided data at all geographic levels (state, public health district, and county, SAU/district, and school), 47 questions were on two versions of the survey and provided county-, public health district-, and state-level data, 82 questions were on only one version of the survey (version A, B, C, or D) and provided state level data only, Version C of the survey satisfied the requirements of the U.S. CDC to be included as part of the 2015 YRBS.

Tobacco Use in High School Students

In 2017, prior to the legislation put into effect, the total number of high school students surveyed in the state was 35,503, with 49% being male and 50% being female and 1% of this information missing (366 students). Of those who used tobacco products, the four largest ethnic groups included: 6,484 White students, 397 Hispanics, 227 of multiple races, and 199 African American. The following individual grades were represented: 9th at 27.3%, 10th at 26.7%, 11th at 24.3%, and 12th at 20.0% with 1.7% of this information missing (604 students). The high school use by sex included: 16.8% of males and 10.4% of females. Of those who used tobacco products, the sexual orientation of the students were: 18.8% heterosexual, 22.8% homosexual, 18.8% bisexual, and 18.1% were unsure.

In 2019, after the legislation was in effect, the total number of high school students surveyed in the state was 35,156, with 49.2 % being male and 49.9% being female and 1% of

this information missing (341 students). Of those who used tobacco products, the four largest ethnic groups included: 4,819 White students, 287 Hispanics, 197 of multiple races, and 138 African American. The following individual grades were represented: 9th at 28.3%, 10th at 26.1%, 11th at 23.0%, and 12th at 21.2% with 1.4% of this information missing (490 students). The high school use by sex included: 12.6% of males and 8.1% of females. Of those who used tobacco products, the sexual orientation of the students were: 9.6% heterosexual, 14.7% homosexual, 15% bisexual, and 13.5% were unsure.

Types of Tobacco Use in High School Students

The five indicators assessed in this survey include the following: cigarettes, e-cigarettes, cigars, and smokeless tobacco, and any form of tobacco. In 2017, prior to Tobacco 21 legislation going into effect, the product use was the following among high schoolers in tobacco users: 8.8% for cigarettes, 15.8% for e-cigarettes, 7.7% for cigars (little and big), 5% for smokeless tobacco, and any form of tobacco was at 22.5%.

In 2019, after the Tobacco 21 legislation went into effect, the product use was the following among high schoolers in tobacco users: 7.1% for cigarettes, 28.7% for e-cigarettes 5.7% for cigars (little and big), 4.5% for smokeless tobacco, and any form of tobacco was at 10.6%. From these results, it seems that cigarette, cigar, smokeless tobacco, and any form of tobacco use dropped after the legislation was in effect. However, e-cigarette use was significantly higher after implementation.

Urban vs Rural

The state of Maine to many people may seem rural with not too many cities or urbanized areas, however the state has several of both rural and urbanized areas. The urban counties of the state total five (Androscoggin, Cumberland, Penobscot, Sagadahoc, and York) out of sixteen. In

the 2017 survey, the findings of the number of students who used tobacco products and lived in the urban counties totaled 4,340, which was an average of 13.2% of the total high school population in those counties. The number of students who used tobacco products and lived in the rural counties totaled 3,245, which was an average of 15.3% of the total high school population in those counties.

In the 2019 survey, the findings of the number of students who used tobacco products and lived in the urban counties totaled 3,062, which was an average of 10.1% of the total high school population in those counties. The number of students who used tobacco products and lived in the rural counties totaled 2,537, which was an average of 12.5% of the total high school population in those counties. For both surveys, there are more students living in rural areas who use tobacco products; additionally, there was a decrease in use from survey to survey after the implementation of the state's Tobacco 21 law.

Summary

Figure 1: (Detailed State Results)

	Hawaii	California	Oregon	Maine
Tobacco Use in High School Students	There is roughly a 50/50 split with males and females, with the same majority of ethnic groups, and underclassmen making up most of the schools in both surveys. Males mostly smoked.	There is roughly a 50/50 split with males and females, with the same majority of ethnic groups, and underclassmen making up most of the schools in both surveys. Males mostly smoked.	There is roughly a 50/50 split with males and slight edge with females, with the same majority of ethnic groups, Tobacco use rose after the Tobacco 21 policy.	There is roughly a 50/50 split with males and females, with the same majority of ethnic groups, and underclassmen making up most of the schools in both surveys. Males mostly smoked.
Types of Tobacco Use in High School Students	Cigarette, cigar, and smokeless tobacco use dropped after the legislation was in effect. However, e-cigarette and any form of tobacco use were higher after implementation.	Cigarette, cigar, smokeless tobacco, and any form of tobacco use dropped after the legislation was in effect. However, e-cigarette use was higher after implementation.	Cigarette, cigar, and smokeless tobacco use dropped after the legislation was in effect. However, e-cigarette and any form of tobacco use was higher after implementation.	Cigarette, cigar, smokeless tobacco, and any form of tobacco use dropped after the legislation was in effect. However, e-cigarette use was significantly higher after implementation.
Urban vs Rural	A majority of the state is urban with one school system.	There are more tobacco users in rural areas and fewer users after Tobacco 21 implementation.	There are more tobacco users in rural areas and fewer users after Tobacco 21 implementation.	There are more tobacco users in rural areas and fewer users after Tobacco 21 implementation.

Figure 2: (Overall Average Tobacco Type Use Change)

	Cigarettes	Cigars	Smokeless	E-cigarette	Combined
Total	3.6% decrease	2.5% decrease	1.4% decrease	10.2% increase	1.0% increase

Figure 3: (Overall Average Urban/Rural Use Change)

	Urban	Rural
Total	4.2% decrease	4.4% decrease

Discussion

Observations from each of these states concludes that the data shows the differences each implementation has made on the effected population. Each of these states had their respective health departments administer a survey with various questions related to health which included several questions on tobacco use. The questions were administered to school districts throughout each state and was both voluntary and anonymous. The data produced by the answers of this survey were both analyzed and posted on each state's department of health websites from years past and present. The assessed implementation of these states allows for comparisons and observations to be made about their Tobacco 21 policy. The different cultures of each area would have created slightly different outcomes and that has been shown in the results. The results of the Tobacco 21 policy of each state was evaluated based on three key categories: Tobacco Use in High School Students, Types of Tobacco Use in High School Students, and Urban vs Rural.

Hawaii, California, and Maine produced the same results with regards to sex, ethnic groups, and class type with tobacco use in high schools before and after implementation. Oregon was a little different because the survey itself was administered only to 11th graders. Therefore, the results are reflective of only one group compared to a larger student range from the other states. Also, in Oregon, the sex results were similar with the female tobacco population slightly higher than males. There were not any big surprises with the use among high school students and no big changes were expected. In category of types of tobacco use, across all four states, the data shows that cigarette, cigar, and smokeless tobacco use went down due to the implementation;

consequently, across all four states, e-cigarette use rose regardless of Tobacco 21. The observed results of urban vs rural use of tobacco, in California, Oregon, and Maine, there are more rural users of tobacco compared to urban users. Hawaii is in a unique position in which the entire state has one school district with roughly 91% of individuals that live in an urban area. This would give the state's school population the urban distinction.

These results show how the implementation went and what would likely be the results of a nationwide execution. A study such as this has not been performed in the past with numerous states merely because of the recent push for and passing of Tobacco 21 regulations in other states. Now that numerous states have had these policies for several years, there is data available for use. The results reinforce certain initial thoughts about reduced product use. Certain products were more popular than others, if a social group did not partake in using as much of a product regularly, then a policy like this would cause numbers to fall. The results also show what could be worked on and improved which is a great benefit for public health officials. E-cigarettes have risen despite implementation and need to have direct attention in order to reduce the number. Rural areas are also at greater risk for tobacco use and need to be a focus point as well. While a good deal of policies focus on issues in urban areas, the rural areas tend to be forgotten and this is proof of a greater need for assistance in those areas. This must now lead to further action and what can be done in order to have a better result nationwide with the new legislation in effect. In the future, there is hope that more data would be available for an even better analysis of this policy and what effects it has on youth. Some states do not publish certain data for quite some time and this information could have greatly benefit not only this study, but several others.

Recommendations

Based on the data, e-cigarettes and rural areas are clearly two items that can be improved upon. Recently, there have been a large number of cases against e-cigarette use throughout the country with the CDC closely involved. Recent studies have shown that flavored e-cigarettes are popular among the youth and the use has caused negative cardiovascular, pulmonary, DNA, and cell effects; additionally, in some extreme cases, even death. Now that there is clear recognition that e-cigarettes are an issue from both recent negative events and through research of this paper, I would recommend a stricter policy on e-cigarettes. This could be done in two ways: Purchase Limitations for those aged 21-25 or a School/Police Policy.

The purchase limitation for the specific age range has the potential to stop individuals from purchasing a great number of e-cigarette products and giving them to their counterparts who are minors. Limitations would lead to an increasing effort on the purchaser's part to attain the e-cigarette products; therefore, the purchaser may not want wish to go through more effort for another person. A school/police interaction policy would entail the following: each high school would have a faculty tobacco representative; this faculty member would report incidences of high schoolers to the police. The police would then fine the parents or guardians of the child a certain amount (e.g. \$100, \$200) and the child would be given a certain amount of community service (e.g. 10-20 hours per offense). The school, parents, and child now involve themselves in the behavior individual.

Rural areas of the country are also more at risk for overall use of tobacco products. These most likely resulted from the demographic and psychosocial factors that are typically associated with rural areas, such as lower income, education level, and higher unemployment. There is great difficulty in finding a solution to prevent or reduce rural communities from smoking. Legal,

economic, social, and physical environments all shape tobacco use behavior. The recommendation, based on literature research, are higher taxes on these products as well as an increased use in media and education; which, has been shown to have the best results for achieved lower use.

Local municipalities are an important factor and have the potential to add their own taxes on tobacco products. State constitutions and laws specify the powers of local governments, and these may prohibit or expressly allow local governments to use certain powers by the state. Where delineation of powers is unclear, most states use something called “Dillon’s Rule”, meaning that local governments can only exercise authority explicitly delegated to them. However, many states may grant local governments general power to manage their affairs under a “home rule” charter that gives the municipality greater law and policy-making authority, including ability to add taxes (Tobacco Control Legal Consortium 2015). Rural local governments in states would be a primary driver in this effort to reduce tobacco use among their citizens.

Media and education are the second recommendation which could have beneficial results. Educators visiting rural areas of the country have the opportunity to fully educate on tobacco use and their effects on the body. The more education a person has about a particular subject, the better they are on making a decision to invest in it. Advertising and using media to inform and educate are also ideal in reducing the rural tobacco use. A memorable thought, idea, or picture serves greatly with the decision making of an individual, especially an adolescent. Enacting certain strategies may be less or more beneficial than others; however, the most effective ones are being done at the present time and in the future. The more strategies and knowledge obtained, the better the results are with reducing future tobacco use.

Limitations

A limitation of this study was that it was based on the experiences of only four state health departments. To have a better interpretation and result, these states were selected because of the amount of time that a Tobacco 21 Policy had been in effect and because of the public information available. If information for other states were made publicly available, then a clearer result would have been made. This policy is extremely new, so all things considered, the results obtained are great. The interview questions were also a limitation for this project for three reasons: first, the consistency of the questions asked from state to state, second, in California and Oregon, the surveys were administered to certain grades, and third, voluntary participation to answer questions. Each state had their own standard of questions asked for several health-related issues not merely tobacco use. The tobacco related questions were similar, however, the wording was the difference between states. In California and Oregon, because not all grade levels were measured, there are limitations to the information gathered. If each grade was measured similar to Hawaii and Maine, then better data would have been collected. Comparable to all voluntary surveys, students were asked to voluntarily answer these questions throughout each of the four states. There were students who did not take the survey and so there could be data that might change the results and provide better information for researchers.

Conclusion

Tobacco 21 policies are a crucial component to reducing smoking and tobacco use through a preventive effort. Since 95% of adult tobacco users will start before the age of 21, having this regulation in place can have several benefits from preventing several individuals from becoming tobacco users to minimizing health issues later in life. Some of the benefits that can come from tobacco cessation include: reduction in morbidity and mortality from respiratory

disease, reduction in tobacco-related cancer, lower risk of stroke, lower risk of coronary artery disease (CAD) and chronic obstructive Pulmonary disease (COPD), etc. The states in this paper have laid down the groundwork for the states that follow with similar policies and likewise the federal legislation enacted in December 2019. Hawaii, California, Oregon, and Maine have had great success with their individual state policies, and the results of the numerous states that have enacted their own policies in 2019 will hopefully have similar results when their data comes out in the future. Many states, prior to federal legislation, did not implement any sort of policy to reduce tobacco use and there are numerous reasons behind the decision from political to agricultural to economic.

Raising the purchasing age of tobacco to 21 seems to have taken off in areas willing to accept the idea and the positive impact the change may bring. Legislators in Congress and other state governments have been attempting to create bills for either state or a nationwide mandate for quite some time, but have gotten nowhere. Now that the federal government supports and approves of this order, public health and other healthcare fields are confident in the results to come. Now, state and local public health officials are tasked with making sure that these regulations are met at schools, retail stores, and other locations.

The purpose of this project was to provide an in-depth look into before and after the state level Tobacco 21 legislation was implemented. The analysis in this project examined specific characteristics of the population of each state and how they changed. The goal was to observe the change of tobacco use in high school students, types of tobacco, and urban/rural use. The states' experiences were also used to project what the national impact would be. The data obtained provides information on where the policies have been successful and where they have not and need to be further improved. Communities where this policy will be significant to the

adolescent should know how to properly enforce and educate so that a successful implementation happens. Schools, law enforcement, retail stores, and public health officials need to each perform their role so that those who use these products will cease. Tobacco 21 aims to prevent the future generation from smoking and if raising the age limit to 21 makes the difference that research has shown, then this should have been implemented years ago. This project data is evidence that Tobacco 21 is effective and a crucial part of public health. This great step has the potential to significantly reduce tobacco use and to make the United States, a healthier nation.

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