Executive Summary: Health Impact Review of SB 5025

Concerning the Age of Individuals at Which Sale or Distribution of Tobacco and Vapor Products May be Made (2018 Legislative Session)

Evidence indicates that SB 5025 would likely decrease use of tobacco and vapor products among youth and young adults, thereby improving health outcomes. It is unclear how the bill would impact health disparities, though some evidence suggests that the effect on disparities may be neutral.

BILL INFORMATION

Sponsors: Senators Miloscia, Walsh, O'Ban, Darneille, Cleveland, King, Keiser, Pedersen, Frockt, Liias, Hunt, Chase, Kuderer

Summary of Bill:

- Prohibits selling or giving tobacco or vapor products to a person under the age of 21.

HEALTH IMPACT REVIEW

Summary of Findings:

This Health Impact Review found the following evidence regarding the provisions in SB 5025:

- A fair amount of evidence that changing the minimum age for purchase of tobacco and vapor products from 18 years to 21 years of age will likely decrease use of tobacco and vapor products among youth and young adults.
- Very strong evidence that decreasing use of tobacco and vapor products among youth and young adults will likely improve health outcomes.
- Unclear evidence for the bill's impacts on health disparities. Some evidence indicates that increasing the minimum purchase age is associated with decreased smoking rates across income, race and ethnicity, and grade level—indicating that the impacts of the bill on health disparities is potentially neutral. However this is only preliminary evidence and a large body of evidence has not yet been established. Other factors may also influence how this bill impacts disparities such as access to tobacco on tribal lands and military bases, the potential disparate impacts of possession laws on youth and young adults of color, and smoking rates during pregnancy. Each of these factors is analyzed in more detail in the full Health Impact Review.

For more information contact:
(360)-236-4109 | hir@sboh.wa.gov
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Health Impact Review of SB 5025

Concerning the Age of Individuals at Which Sale or Distribution of Tobacco and Vapor Products May be Made (2018 Legislative Session)

February 1, 2018

Staff contact: Lindsay Herendeen

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Introduction and Methods

A Health Impact Review is an analysis of how a proposed legislative or budgetary change will likely impact health and health disparities in Washington State (RCW 43.20.285). For the purpose of this review 'health disparities' have been defined as the differences in disease, death, and other adverse health conditions that exist between populations (RCW 43.20.270). This document provides summaries of the evidence analyzed by State Board of Health staff during the Health Impact Review of Senate Bill 5025 (SB 5025).

Staff analyzed the content of SB 5025 and created a logic model depicting possible pathways leading from the provisions of the bill to health outcomes. We consulted with experts and contacted stakeholders with diverse perspectives on the bill. State Board of Health staff can be contacted for more information on which stakeholders were consulted on this review and previous reviews on this topic. We conducted objective reviews of the literature for each pathway using databases including PubMed and Google Scholar.

The following pages provide a detailed analysis of the bill including the logic model, summaries of evidence, and annotated references. The logic model is presented both in text and through a flowchart (Figure 1). The logic model includes information on the strength of the evidence for each relationship. The strength-of-evidence has been defined using the following criteria:

- **Not well researched:** the literature review yielded few if any studies or only yielded studies that were poorly designed or executed or had high risk of bias.
- **A fair amount of evidence:** the literature review yielded several studies supporting the association, but a large body of evidence was not established; or the review yielded a large body of evidence but findings were inconsistent with only a slightly larger percent of the studies supporting the association; or the research did not incorporate the most robust study designs or execution or had a higher than average risk of bias.
- **Strong evidence:** the literature review yielded a large body of evidence on the relationship (a vast majority of which supported the association) but the body of evidence did contain some contradictory findings or studies that did not incorporate the most robust study designs or execution or had a higher than average risk of bias; or there were too few studies to reach the rigor of 'very strong evidence'; or some combination of these.
- **Very strong evidence:** the literature review yielded a very large body of robust evidence supporting the association with few if any contradictory findings. The evidence indicates that the scientific community largely accepts the existence of the association.

This review was subject to time constraints, which influenced the scope of work for this review. The annotated references are only a representation of the evidence and provide examples of current research. In some cases only a few review articles or meta-analyses are referenced. One article may cite or provide analysis of dozens of other articles. Therefore the number of references included in the bibliography does not necessarily reflect the strength-of-evidence. In addition, some articles provide evidence for more than one research question so they are referenced multiple times.

Analysis of SB 5025 and the Scientific Evidence

Summary of SB 5025

- Prohibits selling or giving tobacco or vapor products to a person under the age of 21.

Health impact of SB 5025

Evidence indicates that SB 5025 would likely decrease use of tobacco and vapor products among youth and young adults, thereby improving health outcomes. It is unclear how the bill would impact health disparities, though some evidence suggests that the effect on disparities may be neutral.

Pathways to health impacts

The potential pathways leading from the provisions of SB 5025 to decreased health disparities are depicted in Figure 1. There is a fair amount of evidence that changing the minimum age for purchase of tobacco and vapor products from 18 years to 21 years of age will decrease use of tobacco and vapor products among youth and young adults.[1-12] There is very strong evidence that decreasing use of tobacco and vapor products among youth and young adults will improve health outcomes for Washingtonians.[1,13,14] It is unclear from available evidence how the bill would impact health disparities. Two studies have found that increasing the minimum purchase age is associated with decreased smoking rates across income, race and ethnicity, and grade level[4,6]—indicating that the impacts of the bill on health disparities is potentially neutral. However this is only preliminary evidence and a large body of evidence has not yet been established. Other factors may also influence how this bill impacts disparities such as access to tobacco on tribal lands and military bases, the potential disparate impacts of possession laws on youth and young adults of color, and smoking rates during pregnancy. Each of these factors is analyzed beginning on page five.

Due to time limitations we only researched the most direct connections between the provisions of the bill and decreased health disparities and did not explore the evidence for all possible pathways. For example, we did not evaluate potential concerns related to the availability of smoking cessation resources for youth. Some members of the community expressed concern about increasing the minimum age to purchase tobacco without also increasing youth access to tobacco cessation resources. These potential impacts on health and health disparities were not included in this analysis.

Magnitude of impact

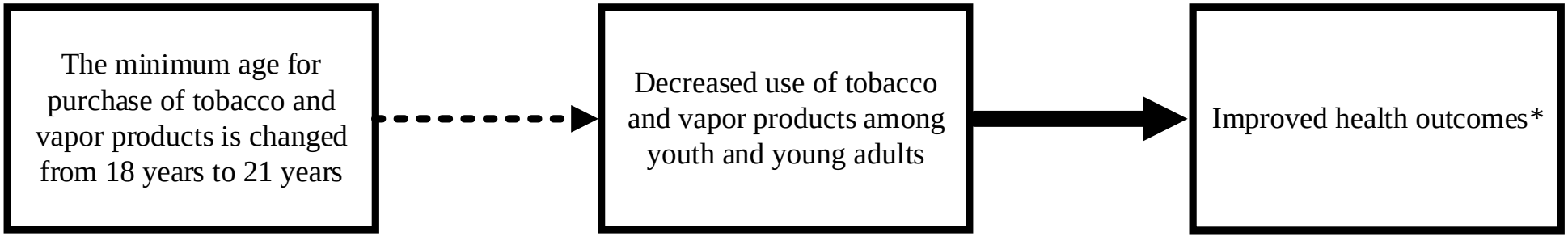
The Institute of Medicine (IOM) convened a committee to examine the existing literature and use modeling to predict the likely impacts of increasing the minimum purchase age to 21 years of age. The committee's modeling was informed by the existing scientific literature and estimated that raising the tobacco purchase age to 21 would lead to the following reductions in tobacco initiation: a 12.5-18% reduction for those under 15 years of age, a 20.8-30% reduction for those 15-17 years, and a 12.5-18% reduction for those 18-20 years.

Decreased smoking initiation rates would likely lead to significant health impacts in the long term. With an age increase to 21, modeling predicted that by 2040-2059 there would be 0.2-0.8% reduction in deaths (8.2-9.9% by 2080-2099); 0.5% reduction in years of life lost (9.3% by 2080-2099); 0.3% reduction in lung cancer deaths (10.5% by 2080-2099); 12.2% reduction in low

birth weight cases; 13% reduction in pre-term birth cases; and 18.5% reduction in sudden infant death syndrome (SIDS) cases.[1] Based on this IOM report, the Washington State Department of Health shared unpublished data that projects that if the minimum age for purchasing tobacco is raised from 18 to 21, 8,500 kids living in Washington who are alive right now will not die prematurely due to tobacco.

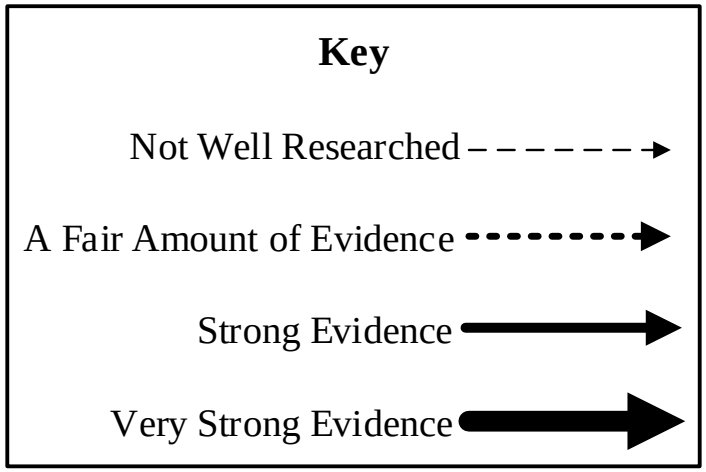
In addition, unpublished data from the Washington State Administrative Office of the Courts (Administrative Office of the Courts, email, January 10, 2018) show that 432 youth under the age of 18 were charged with a civil infraction for possessing tobacco between 2011 and 2017 under RCW 70.155.080. The impact of raising the minimum purchase age for tobacco on the number of youth charged with a civil infraction is unknown. Some members of the community have expressed concern that enforcement efforts may disproportionately target youth of color, and at least one peer-reviewed study has found that African American and Hispanic/Latino youth were significantly more likely to be fined for possessing tobacco than their White counterparts.[1] The data provided by the Administrative Office of the Courts for race and ethnicity and sex are self-reported, and the dataset is not complete enough to run further analyses to examine potential differences by these demographics.

Logic Model



*See the full Health Impact Review for a detailed analysis of the likely impacts of SB 5025 on health disparities

Figure 1
Concerning the Age of Individuals at Which Sale or Distribution of Tobacco and Vapor Products May be Made
SB 5025



Summaries of Findings

Will changing the minimum age for purchase of tobacco and vapor products from 18 years to 21 years of age decrease use of tobacco and vapor products among youth and young adults?

There is a fair amount of evidence that changing the minimum age for purchase of tobacco and vapor products from 18 years to 21 years of age will likely decrease use of tobacco and vapor products among youth and young adults.[1-6,8,10,11] For example, in April 2005 Needham, Massachusetts raised the minimum purchase age for tobacco to 21 years. An analysis of the impact of this legislation demonstrated that from 2006 to 2010, the smoking rate among high school students in Needham decreased by 47%, and this reduction was significantly greater than the reductions seen in 16 comparison communities who had not raised the purchase age.[4] Further, New York City began enforcing a tobacco 21 purchase age in August 2014 and unpublished data provided by the NYC Department of Health And Mental Hygiene demonstrate a decrease in public high school student smoking rates from 8.2% in 2013 to 5.8% in 2015 (NYC Department of Health and Mental Hygiene, email, November 10, 2016).

An additional body of evidence in relation to the effects of raising the minimum purchase age for alcohol indicates that higher alcohol purchase ages are associated with decreased alcohol consumption.[7,9] While research on alcohol purchase polices are not fully generalizable to tobacco and vaping purchase policies, these alcohol studies do provide additional insight into the likely effects of raising the minimum purchase age for tobacco and vaping products.

One of the primary aims of raising the purchase age for tobacco and vapor products is to prevent initiation of smoking among youth and young adults. Data from the 2016 Washington State Healthy Youth Survey indicate that 34.6% of Washington 10th graders say that it would be either 'very easy' or 'sort of easy' to access cigarettes.[15] Further, data from the 2016 survey show that when students were asked how they obtain tobacco products, 76% of Washington 10th graders who used cigarettes said they received cigarettes from 'social or other' sources including friends and family members.[15] Therefore, raising the purchase age and removing some of the social availability of these products from youth and young adults would likely decrease tobacco and vapor product use in this age group.

Although the evidence on the effects of minimum tobacco purchase ages have focused specifically on smoking rates among youth and young adults, it is possible that raising the minimum purchase age could also decrease smoking rates among older adults in the future. Research indicates that 95% of adult smokers begin smoking before they turn 21[12] and early smoking onset is associated with decreased likelihood of cessation.[16] Therefore, declines in the tobacco/vaping use rates associated with increasing the minimum purchase age for tobacco and vaping products may extend beyond the age groups directly impacted by the change.

Will decreasing use of tobacco and vapor products among youth and young adults improve health outcomes?

There is very strong evidence that decreasing use of tobacco and vapor products among youth and young adults will likely improve health outcomes for these individuals, as well as for those who would otherwise have been exposed to their secondhand smoke or smoking in utero.[1,13,14] A

very strong body of evidence has shown a causal link between combustible cigarette smoking and diseases in nearly every organ, cancer (e.g. lung, liver, and colorectal cancer), diminished health status, exacerbation of asthma, inflammation, impaired immune function, age-related macular degeneration, harms to the fetus, diabetes, erectile dysfunction, arthritis, and premature death. Research also shows that secondhand smoke causes cancers, respiratory disease, cardiovascular disease, stroke, and harm to infant and child health.[14]

Beyond the youth who are directly impacted by this bill, SB 5025 may also provide health benefits to infants and children who would potentially, in the absence of the bill, be exposed to secondhand smoke or smoking in utero. Data from the Pregnancy Risk Assessment Monitoring System (PRAMS) from 2010-2012 indicate that smoking rates among pregnant women before and during pregnancy are highest among mothers younger than 20 (36%) and remain high for mothers 20 to 24 years of age (32%).[17] Because women often are not aware that they are pregnant until several weeks into their pregnancy, the smoking rates in the months leading up to pregnancy can have an important impact on fetal development and growth.[17] One study found that the babies of young mothers living in an area with a higher tobacco purchase age during pregnancy actually had better birth outcomes than their counterparts.[10]

There is also strong evidence that decreased vaping rates would lead to improved health outcomes.[13,18] Many studies, including a comprehensive report published in 2016 by the Surgeon General, have found that vaping products contain substances that are harmful to humans (e.g. metals, traces of cancer-causing nitrosamines, formaldehyde, and mercury) and that smoking electronic cigarettes is associated with adverse effects such as airway and lung obstruction and harms at the cellular level.[19] Evidence also indicates that product labels often did not show the concentrations of solvents and flavoring and that products labeled nicotine free were sometimes found to actually contain nicotine in high concentrations. There was also variability in product concentrations from cartridge-to-cartridge. There is a lack of evidence of the long-term impacts of vaping on human health as vapor products are relatively new.[13,18]

Given the limited evidence on the long-term impacts of vapor products, the literature suggests that vaping may have less adverse effects or result in less exposure to harmful substances than combustible cigarettes.[13,18] However, there is insufficient evidence to determine if vaping products are effectively being used to reduce or quit combustible cigarette use. While some studies suggest that e-cigarettes may be useful cessation tools or may help smokers decrease their use of combustible cigarettes, other studies have found that e-cigarette use is associated with a **decreased** likelihood of quitting combustible cigarettes and **increased** consumption of combustible cigarettes.[20-23] A 2016 meta-analysis by Kalkhoran concluded that e-cigarettes, as they are currently being used, are actually associated with lower quit rates among combustible cigarette smokers.[23] Further, while evidence supporting the use of e-cigarettes as a cessation tool for combustible cigarettes is weak for adults, it remains untested among youth and young adults.[19] In addition, emerging evidence suggests that youth and adults who start using electronic cigarettes may be more likely than their peers to begin using combustible cigarettes and other tobacco products.[24,25]

Will improving health outcomes for youth and young adults impacted by SB 5025 impact health disparities?

It is unclear from the available evidence how increasing the minimum tobacco/vaping product purchase and possession age to 21 would likely impact health disparities. Two studies have found that increasing the minimum purchase age is associated with decreased smoking rates across income, race and ethnicity, and grade level[4,6]—indicating that the impacts of the bill on health disparities is potentially neutral. However this is only preliminary evidence and a large body of evidence has not yet been established.

We did not identify any evidence which suggests that increasing the minimum purchase age would increase smoking rates among any subpopulations. Given that the evidence is inconclusive regarding impacts across subpopulations, if an increase in the purchase age *did* lead to an increase in disparities, it would likely be a result of a disproportionate *positive* impact for communities with lower tobacco and vaping rates. There would still likely be a positive effect for all communities. Any observed increases in disparities as a result of smaller declines in smoking rates in some subpopulations could potentially be addressed through culturally and linguistically appropriate tobacco and vaping prevention interventions tailored to those populations.

Disparities by race/ethnicity

We found evidence that rates of smoking and age at initiation of cigarette use vary by race and ethnicity. Data from Washington State's 2016 Healthy Youth Survey indicate that Black and American Indian/Alaskan Native (AI/AN) youth reported smoking combustible and electronic cigarettes at significantly higher rates than their White counterparts across all grade levels (8th, 10th, and 12th).[15] For all grade levels, cigarette and e-cigarette use was highest among AI/AN youth. For example, AI/AN 10th graders report smoking at almost double the smoking prevalence of White students (13% compared to 6%).[15] Combined 2012-2014 Behavioral Risk Factor Surveillance System (BRFSS) data from adults in Washington also indicate that AI/AN respondents report the highest smoking rates into adulthood.[17]

A 2017 study found that, while the rates of smoking initiation have decreased for all adolescent and young adult age groups over time, Black and Hispanic males continue to have higher rates of initiation than their White peers.[26] In addition, a study of middle school students in Rhode Island found that Native American and multiracial students were more likely to initiate cigarette use in early adolescence than other students.[27] Evidence indicates that earlier age of initiation of tobacco use is associated with greater difficulty quitting. Youth who initiate smoking at 13 years or younger have the most difficulty quitting, while each year that a child delays initiation increases their chances of quitting.[16] This suggests that if increasing the tobacco and vaping product purchase age decreases smoking and vaping rates for all racial and ethnic groups and grade levels, it could potentially have greater positive impacts on youth of color and AI/AN youth than their White counterparts as these youth seem to be initiating smoking at a younger age in Washington.[15]

How SB 5025 will affect these nuanced changes in smoking disparities is not clear; however changing the minimum age to purchase tobacco could potentially result in a decline in the disproportionally high smoking rates among AI/AN adults in Washington in the future.

In addition, PRAMS data from 2010-2012 indicate that AI/AN and low-income mothers are more likely than their counterparts to report smoking before pregnancy.[17] This may indicate that decreasing smoking rates evenly across all demographic groups could actually have a greater positive health impact in AI/AN and low-income communities because the decrease would not only benefit the smoker, but her unborn child as well. However, current law (RCW 43.06.455) allows the Governor to enter into cigarette tax compacts with the tribes and stipulates that these compacts must prohibit retailers on tribal land from selling or giving cigarettes to anybody under the age of 18. SB 5025 does not amend this language. If tribal retailers continue to sell tobacco products to young adults between 18 and 20 years of age, it is possible that smoking rates among AI/ANs (and other Washingtonians) living on or accessing goods on tribal land will not be as positively impacted by SB 5025. If this leads to a greater decline in tobacco use among other subpopulations, this could exacerbate the smoking disparities that currently exist for AI/ANs in Washington.

Another point of consideration is the potential impact of SB 5025 on youth of color in regard to police contact and fines. Current law (RCW 70.155.080) provides that an individual under the age of 18 who purchases, attempts to purchase, posses, or attempts to obtain tobacco products commits a Class 3 Civil Infraction and is subject to a fine, participation in up to four hours of community restitution, or both. SB 5025 would increase the age to 21 years. Evidence indicates that people of color are disproportionately represented in every stage of the justice system,[28] and at least one study has found that African American and Hispanic/Latino youth were significantly more likely to be fined for possessing tobacco than their White counterparts.[1] It is not clear from available evidence if receiving a citation is associated with a decrease in tobacco use or intent to use tobacco.[1]

If 18-20 year olds of color are disproportionately targeted for possession of tobacco and vaping products, this could increase disparities that already exist in the justice system. Because involvement in the justice system is associated with negative health outcomes for individuals and their families,[29-34] this could have negative repercussions on health disparities. However, since evidence suggests that raising the tobacco purchase age decreases smoking rates among all racial/ethnic groups,[4] the number of youth of color violating the current under-18 purchase and possession laws will likely decrease. Therefore youth of color under 18 may be less likely to experience police contact as a result of tobacco possession and use even as 18 to 20 year olds may face increased contact. Therefore it is difficult to determine how SB 5025 would impact this component of health equity.

Disparities by income

Washington Behavioral Risk Factor Surveillance System data from 2012-2014 indicate that as income increases smoking rates decrease.[17] One study specifically addressed how smoking rates among students with different family incomes (using eligibility for free school meals as a proxy for family income) were impacted by an increase in the minimum tobacco purchase age. This study found that smoking rates declined equally for non-eligible and eligible students.[6] This suggests that SB 5025 may have neutral impacts on smoking disparities by income; however the evidence is insufficient to make a determination. As mentioned above, PRAMS data from 2010-2012 indicate that low-income mothers are more likely than their counterparts to report smoking before pregnancy,[17] so decreasing smoking rates evenly across all income groups could actually

have a greater positive health impact on low income communities because the decrease would not only benefit the smoker, but her unborn child as well.

Disparities by sexual orientation/gender identity

Data show that 2016 Healthy Youth Survey respondents in Washington who self-identified as lesbian, gay, or bisexual (LGB) reported higher smoking rates than their straight counterparts.[15] Overall, the literature has not addressed if changing minimum tobacco purchase and possession laws impacts LGB and straight youth equally, so it unclear how SB 5025 would impact tobacco use disparities by sexual orientation.

A 2017 study showed that transgender youth are more likely to use tobacco, and to start smoking cigarettes at an earlier age than nontransgender youth.[35] Although this study did not look specifically at how raising the minimum age to purchase tobacco would impact tobacco use among transgender youth, it is possible that raising the smoking age could decrease disparities and improve health outcomes for transgender youth since smoking into adulthood is more likely the earlier smoking is initiated.

Disparities by military status

National data indicate that active duty military members are more likely than civilians to report currently smoking, and that veterans are also more likely to be current smokers than non-veterans[36]. However, BRFSS data and Health Related Behavior Survey data for Active Duty Service Members from 2011 suggest that in Washington State, the rates among active duty personnel, the general population, veterans, and non-veterans are similar.[37,38] Because SB 5025 would not affect the minimum tobacco/vaping product purchase age on military bases in Washington, it is possible that this bill could have a smaller impact on decreasing tobacco and vaping product use among active duty personnel, thereby potentially creating a disparity or exacerbating disparities that already exist at the national level. It is important to note that in Hawaii, where a tobacco 21 purchase age law was passed in 2015, the U.S. Army, Department of the Navy, and the Marine Corps all announced their support and all military bases decided to comply with the law.[a,39] Similarly, the U.S. Navy stated that it supported California's efforts to pass a Tobacco 21 law, which went into effect in 2016.[39] If military bases in Washington decided to comply with SB 5025, this could potentially have a positive impact on disparities in smoking rates for military personnel.

Other considerations

We also explored the potential impacts of the bill on businesses that sell tobacco or vaping products as economic health can affect human health. We ultimately did not include these pathways in the logic model on page three of this review because the impacts on business have not been well researched. We did not identify any studies which have analyzed the impact of increasing purchase ages (of tobacco, alcohol, etc.) on business solvency, jobs, wages, or prices. One publication noted that no tobacco retailers have gone out of business in Needham, Massachusetts since it implemented a tobacco 21 purchase age in 2005,[40] but this has not been studied rigorously.

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[a] This correspondence can be found here in a media release from the U.S. Army Garrison, Hawaii, and in administrative messages from the Navy (NAVADMIN 298/15) and Marine Corps (MARADMIN 649/15).

Similarly, there is little evidence for how minimum purchase age laws impact retailer compliance and how compliance then affects usage of the restricted product. One study in New York City found that retailer compliance with tobacco control laws actually decreased after Tobacco 21 laws went into effect, with the percentage of retailers checking ID falling from 71% to 62% after implementation.[41] The authors point out that retailer compliance is important to ensure the success of Tobacco 21 laws, and note that New York City did not appropriate any additional funding to ensure retailer compliance when they passed Tobacco 21 laws in 2014.[41]

Lastly, one study estimated the impact of a national tobacco purchase age of 21 on cigarette sales. Winickoff et al. (2014) used national data on the proportion of legal tobacco sales that are made by (or for) 18 to 20 years olds to estimate the potential impact on retailers if the sale age is increased to age 21.[40] Winickoff notes that 18 to 20 year olds account for 2.12% of the total cigarette consumption in the United States and therefore, if all 18 to 20 year olds stopped smoking following an increase in the purchase age, the maximum amount that sales revenue could decline would be close to 2%.[40] This estimate is also based on the notion that there would be universal implementation and enforcement of the law. Assuming that the policy would have a long-term impact on smoking rates of adults in the future (through the aging of this low tobacco-use cohort), this could lead to a gradual reduction in the sale of cigarettes to older adults over time. This estimate does not account for other tobacco product or vaping product sales.[40] Further, New York City began enforcing a tobacco 21 purchase age in August 2014 and unpublished preliminary data demonstrates that the rate of decline of tobacco tax revenue remained steady before and after implementation. This finding strongly supports the projections from the IOM that an immediate impact on revenue from would be small, particularly because raising the purchase age delays or prevents the initiation of smoking rather than causing current smokers to quit.[1] Given the scarcity of research on the impact of age of purchase laws on business we are unable to make a conclusion about how SB 5025 would likely impact businesses.

Annotated References

1. **IOM. Public health implications of raising the minimum age of legal access to tobacco products. Washington D.C.: The National Academies Press; 2015.**

The Tobacco Control Act of 2009 directed the Food and Drug Administration (FDA) to convene a panel of experts to conduct a study on the health impaction of raising the minimum purchase age for tobacco products and submit a report to Congress. The FDA contracted with the Institute of Medicine (IOM) to convene a committee to examine the existing literature and use modeling to predict the likely impacts of increasing the minimum purchase age to 21 or 25 years of age. The committee concluded in their report that increasing the minimum purchase and possession age for tobacco products would likely prevent or delay initiation of tobacco use by adolescents and young adults and therefore also lead to a "substantial reduction in smoking-related mortality." The authors also concluded that while (for a purchase age of 21) 18 to 20 year olds would be affected, the largest reduction in tobacco initiation would likely be among 15 to 17 year olds. They note that increasing the purchase age to 19 would likely have a modest impact on decreasing tobacco access to minors compared in increasing the age to 21. The authors cite evidence that younger age of smoking initiation is associated with heavier smoking later in life, a higher likelihood of continuing to smoke through the lifespan, and increased risk of adverse health outcomes. The report also summarizes the literature on the effect of tobacco purchase, use, and possession (PUP) laws. A 2008 study conducted in California by Rogers et al. found that in the previous 12 months, across all 249 enforcement agencies statewide, an average of 24.1 citations were issued per agency. A study by Gottlieb et al. also found that African-American and Hispanic students were significantly more likely than their White counterparts to receive a PUP citation. Jason et al. (2007b) found that youth who were fined for PUP violations were more likely than youth in a tobacco prevention education program to reduce or quit tobacco use. However Gottlieb et al. (2004) found that receiving a PUP citation was only associated with reduced smoking intention in some of the sample schools. The committee conducted modeling (informed by the existing scientific literature) and estimated that raising the tobacco purchase age to 21 would lead to the following reductions in tobacco initiation: 15% (range: 12.5-18%) reduction for those under 15 years of age, 25% (range: 20.8-30%) reduction for those 15-17 years, 15% (range 12.5-18%) reduction for those 18-20 years. Their modeling predicts that with an age 21 minimum, by 2040-2059 there would be 0.2-0.8% reduction in deaths (8.2-9.9% by 2080-2099); 0.5% reduction in years of life lost (9.3% by 2080-2099); 0.3% reduction in lung cancer deaths (10.5% by 2080-2099); 12.2% reduction in low birth weight cases; 13% reduction in pre-term birth cases; and 18.5% reduction in sudden infant death syndrome (SIDS) cases.

2. **Chaloupka F. Grossman, M. Price, tobacco control policies, and youth smoking. *NBER Working Paper No. 5740.* 1996.**

Chaloupka and Grossman analyzed national survey data collected annually from 1992 through 1994 with eighth, tenth, and twelfth grade students as part of the University of Michigan's Monitoring the Future Project. Each year approximately 15,000 to 19,000 students in each grade are included in the sample. The total sample included 110,717 respondents with compete data (response rate not noted). The authors added age of purchase policies in each county to the dataset. This ecological study found that as the minimum purchase age increased, tobacco use among surveyed youth showed a statistically significant increase. A causal relationship between

these two variables cannot be determine using this study design (e.g. Did the jurisdictions increase their minimum purchase age to address high smoking rates? Did the minimum purchase age contribute to high smoking rates? Or were there other uncontrolled for variables that impacted both?). The authors note that there was limited variation in the purchase age (from 18 to 19 with only one state with a minimum of 21) and that these laws were poorly enforced at this time.

3. **Fidler J. A., West R. Changes in smoking prevalence in 16-17-year-old versus older adults following a rise in legal age of sale: findings from an English population study. *Addiction.* 2010;105(11):1984-1988.**

On October 1, 2007 England, Scotland, and Wales increased the legal age to purchase tobacco from 16 to 18 years. Smoking among 16 to 17 year olds, however, remained legal. Fidler et al. analyzed data from the monthly Smoking Toolkit Study of randomly selected households and compared the prevalence of smoking among 16-17 year olds compared to other age groups after the age to purchase tobacco was increased. The surveys are collected through face-to-face interviews with one member (over 16 years) from the selected household and then the data are weighted to ensure they are representative of the population in England. The analysis included data from November 2006 through May 2009 and included 53,322 participants (response rate not noted). While the smoking rate declined for all age group after implementation of the higher age law, this change was only significant for three age groups (16-17 year olds, 18-24 year olds, and 55-64 year olds), and the greatest decline was among 16-17 year olds (7.1%). The decline in smoking prevalence after the law change for respondents under 18 years was significantly greater than the decline among respondents 18 and older.

4. **Kessel Schneider S., Buka S. L., Dash K., et al. Community reductions in youth smoking after raising the minimum tobacco sales age to 21. *Tob Control.* 2016;25(3):355-359.**

In April of 2005 Needham, Massachusetts raided the minimum age to purchase tobacco to 21 years. Kessel-Schneider et al. used data from the MetroWest Adolescent Health Survey to determine if smoking rates had declined at a different rate in Needham than in 16 nearby communities that had not raised the minimum age to 21, and also to determine if the effects were specific to tobacco or if similar patterns excited for youth alcohol use. This school-based health survey is administered every other year to students in grades 9-12 starting in the fall of 2006. Seventeen of the 26 public high schools in the region participated in all four years of the survey (2006, 2008, 2010, and 2012). Participation rates among students ranged from 88.8% to 89.6%, with from 16,385 to 17,089 students participating each year. The authors controlled for two factors of school composition—percent of students receiving free and reduced lunch and percent of Caucasian students. In 2006 the smoking rates were not significantly different between Needham and the 16 comparison communities. From 2006 to 2008 and also from 2008 to 2010 the smoking rates decreased significantly more in Needham than in the comparison communities. From 2010 to 2012, the smoking rates decreased significantly more in the comparison cities than in Needham. The authors indicate that this suggests that raising the minimum purchase age may lead to a greater decline in smoking in the years immediately after the policy change. When looking at the time period from 2006 to 2010 the authors found that the smoking rates declined significantly more in Needham than in the comparison communities. This trend was true for all

observed subgroups (females, males, Caucasian, non-Caucasian, and for each grade except for 9th graders who reported low smoking rates). From 2006 to 2012 the percentage of students under 18 who reported purchasing cigarettes in stores declined significantly more in Needham (from 18.4% to 11.6%) than in the comparison communities (from 19.4% to 19.0%). The authors also found that this greater decline in Needham occurred between each of the survey years, but that the decline between 2010 to 2012 was not significantly greater in Needham than the comparison communities. There was a general decrease in alcohol use between 2006 and 2012, but there was not a significant difference in the decline between Needham and the comparison communities. The authors note that the age change was paired with enforcement efforts across Massachusetts. In 2008 there were 57 compliance checks in Needham, and zero illegal sales to those under age 18 were identified. The researchers highlight a few limitations of the study, such as a lack of baseline data because the first survey was administer over a year after the legislation was adopted. They note that Needham and one of the comparison communities passed a law in 2009 prohibiting tobacco sales in pharmacies, which may also have impacted smoking rates. They note that no other tobacco legislation passed during the study period, but that they did not account for non-policy tobacco programs in Needham or the comparison communities.

5. **Lewit E.M., Hyland, A., Kerrebrock, N., et al. Price, public policy, and smoking in young people. *Tobacco Control.* 1997;6(Supplement 2):S17.**

Lewit et al. analyzed data from two cross-sectional, school-based surveys. The surveys were conducted with ninth graders from randomly selected classrooms in 21 communities (one in Canada and the rest in the United States) in 1990 (n=8,504 students) and 1992 (n=8,858 students). Student and parent refusal rates were 4% in both 1990 and 1992. Almost 89% of these respondents had complete data and were included in the analyses. Smoking "participation" was defined as smoking at least one whole cigarette in the past 30 days. The authors included a number of variables in their multivariate logistic regression models including: age, race, sex, exposure to tobacco education in school, exposure to pro- and anti-tobacco messages, cigarette price in the area, and tobacco control policies in the area. They found that policies that restricted purchase of cigarettes for those under 18 years were associated with lower smoking participation among both male and female students in the sample. These policies were not associated with non-smoking participants' reported intent to smoke in the future.

6. **Millett C., Lee J. T., Gibbons D. C., et al. Increasing the age for the legal purchase of tobacco in England: impacts on socio-economic disparities in youth smoking. *Thorax.* 2011;66(10):862-865.**

On October 1, 2007 England, Scotland, and Wales increased the legal age to purchase tobacco from 16 to 18 years. Millet et al. explored the impact of the change on the disparities in access to cigarettes and smoking behavior in England. The authors analyzed 2003 to 2008 data (with 2007 data excluded) from the Smoking, Drinking, and Drug Use Among Young People in England annual survey. This school-based survey is conducted with a random sample of 11-15 year olds. In 2008 the survey had a 58% response rate among schools (264 schools) and an 88% response rate among selected students in these school (n=7,798 students). The survey schools were reflective of the schools in England generally. The researchers controlled for several potential confounding factors (age, gender, race/ethnicity, and past alcohol or drug use) in their analysis. They found that students receiving free school meals (FSM)—a proxy for family income—were

more likely to smoke than their counterparts. The year after the minimum tobacco purchase age was increased to 18 years, there was a significant reduction in regular smoking (smoking at least one cigarette per week) among students (adjusted OR 0.67 [95% CI 0.55-0.81]). There were not significant difference in the effect on smoking rates for students eligible for FSMs and their counterparts. There was also a significant decrease after the law passed in the number of regular smokers who reported usually buying cigarettes from a commercial vendor or vending machine. This trend was true for both FSM and non-FSM eligible students accept for purchases from vending machine which did not decline significantly for FSM eligible students. Both groups of students did report a significant increase in the rates of buying cigarettes from friends, relatives, and others following enactment of the law. FSM eligible students were no more likely than their counterparts to usually buy cigarettes from these sources in both 2006 (before the law) and in 2008. There were significant increases in the number of non-FSM regular smokers who reported that it was difficult to buy cigarettes from a shop and also a significant decrease in the number of non-FSM respondents who reported that their last attempt to buy cigarettes from a shop was successful after implementation of the law. These trends were not significant among FSM regular smokers; however there was no significant difference between the FSM and non-FSM regular smokers in the ease of purchase in either 2006 or 2008. The authors conclude that increasing the minimum age to purchase tobacco in England was associated with a significant reduction in smoking among youth with neutral impacts on disparities by FSM.

7. **Norberg K. E., Bierut L. J., Grucza R. A. Long-term effects of minimum drinking age laws on past-year alcohol and drug use disorders. *Alcohol Clin Exp Res.* 2009;33(12):2180-2190.**

Norberg et al. cite several studies on the connection between MLDA policies and alcohol use conducted after 1999 (the cut-off year for studies included in the 2002 systematic review by Wagenaar and Toomey summarized in this health impact review). The authors indicate that most of these studies have "found that higher MLDAs led to later initiation of drinking and reduced frequency of heavy drinking." The authors analyzed the connection between adolescent exposure to different minimum legal drinking ages and later alcohol and substance use disorders using data from the 1991 National Longitudinal Alcohol Epidemiological Survey and the 2001 National Epidemiological Study of Alcohol and Related Conditions (total n=33,869 respondents). They controlled for a number of potential confounding factors and found that adults who had been legally allowed to purchase alcohol before age 21 were significantly more likely to have an alcohol use disorder or other drug use disorder in later adulthood.

8. **Rimpela A. H. The effectiveness of tobacco sales ban to minors: the case of Finland. *Tobacco Control.* 2004;13(2):167-174.**

March 1, 1977 Finland introduced a ban on tobacco sales to people "apparently" under 16 years of age. In 1995 this age limit was raised to 18 years. Every two years, starting in 1977, the Adolescent Health and Lifestyle Survey (AHLS) was mailed to a nationally representative sample of 12, 14, 16, and 18 year olds in Finland. The response rates (separated by sex) ranged from 50-92% depending on the year, but were above 70% in most years. Every year since 1996 the School Health Promotion Survey (SHPS) has been administered in eighth and ninth grade classrooms. The authors included schools in the analysis that had participated in each of the following years: 1997, 1999, 2001, and 2003 (n=226,681). Participation ranged from about 20%

to 80% of the Finish municipalities depending on the year. The percentage of 14 year old daily smokers who reported buying tobacco for themselves from a commercial source had a slight but significant decrease from 1977 (when the age 16 limit was enacted) to 1981(from 87% to 83%) , while no significant change was observed among the 16 and 18 year olds. In these same years there was a significant decrease in the proportion of 14 year old daily smokers who bought tobacco from shops (one commercial source), a trend that was seen among 16 year olds (not targeted by the law) as well. Between 1995 (when the age 18 limit was enacted) and 2001 there were significant decreases in the number of 14 and 16 year olds who reported purchasing tobacco, while no significant change was observed among 18 year olds. In these same years there were significant decreases in the proportion of 14 and 16 year old daily smokers who had purchased tobacco from shops and kiosks, while there were no significant changes among 18 year olds. However, purchases of tobacco from other outlets increased in 14, 16, and 18 year olds from 1995 to 1997. This trend reversed among 14 and 16 year olds between 1999 and 2003, but not among 18 year olds. There was also a significant increase in the purchase of tobacco from friends among 16 year olds from 1995 to 1997. There was a decrease in daily smoking among all age groups after 1977, but this was a short term change. There was no immediate decrease in daily smoking after the 1995 legislation, but there was a significant decline in smoking rates between 2001 and 2003 among all 14 year olds and among 16 year old boys. Smoking rates among 18 year olds remained flat during the entire period. The delay between the 1995 legislation and the 2001-2003 decline in smoking rates implies that factors other than the increase to age 18 (or some interaction of factors with the age increase) led to this decline rather than the smoking age increase alone. Daily consumption of cigarettes did not diminish after the 1977 or 1995 policy changes. The authors speculated that a lack of enforcement of the bans and the fact that the bans did not address social sources of tobacco may be responsible for a lack of sustained change to the smoking rates immediately following the legislation changes. The lack of enforcement was highlighted by data indicating that in 2002-2003 72% of schoolchildren reported that it was very easy or fairly easy to buy tobacco from a commercial source.

9. **Wagenaar A.C., Toomey, T.L. Effects of minimum drinking age laws: Review and analyses of literature from 1960 to 2000.** ***Journal of studies on alcohol.*** **2002;14(Supplement):206.**

Wagenaar and Toomey conducted a systematic review of the literature published between 1960 and 1999 on the impacts of minimum legal drinking age (MLDA) laws. The authors identified 132 studies. They graded the quality of each study based on sampling design, study design, and presence of a comparison group. Forty-eight of these studies looked at the impact of MLDA laws on indicators of alcohol consumption; and these studies looked at 78 alcohol consumption outcome measures. Twenty-seven of these 78 analyses (35%) found that as the legal age was raised alcohol consumption decreased significantly or as it was lowered alcohol consumption increased significantly (an inverse relationship between the MLDA and alcohol consumption). Eight additional analyses also found this inverse relationship between the MDLA and drinking—but they did not report statistical significance. Five of the 78 analyses found a positive association between the MLDA and alcohol consumption. Only 17 of these 78 analyses reported statistical significance; used higher quality study designs, a probability sample or census, a comparison group, and an indicator of alcohol consumption (rather than alcohol purchase). Of these 17 higher quality analyses (from 14 different studies) eight (47%) found that increases in the MDLA were associated with significant decreases in alcohol consumption. One analysis

found that the MLDA increase was associated with an increase in alcohol consumption, and eight analyses (47%) found no significant change in alcohol consumption. The authors conclude that several factors may account for the variability in results, including by how many years the MLDA was increased.

10. **Yan J. Does the Minimum Cigarette Purchase Age of 21 Protect Young Mothers from Cigarettes, Help Their Babies?** ***Department of Economics, Appalachian State University.*** **2011;11-17.**

Yan analyzed national birth sample data (which consists of all live births in Pennsylvania) using a regression discontinuity method to estimate the impact of the age 21 tobacco purchase legislation that existed in Pennsylvania from 1992 to 2002. Yan analyzed the impact of this legislation on young mothers' cigarette use and their babies' birth outcomes. The response rate for each of the smoking variables was over 98% (n=60,710). Yan excluded mothers who were born outside of the United State or who resided in states other than Pennsylvania. Yan only included women whose age at conception was within 10 months to either side of the purchase age cut-off and who conceived between October 1, 1992 and July 10, 2001. The author controlled for potential confounding factors and found that mothers over the age 21 threshold during their pregnancy were significantly more likely than their counterparts to smoke cigarettes and also that they reported smoking significantly more cigarettes per day. The babies of mothers who were old enough to legally purchase cigarettes during their pregnancy also had significantly worse birth outcomes than their counterparts (e.g. lower birth weight, shorter gestation, and lower APGAR scores). Yan speculates that these data indicate that the tobacco 21 legislation had positive impacts on lower smoking rates and volume and on positive birth outcomes.

11. **Yoruk C., Yoruk, B. Do Minimum Legal Tobacco Purchase Age Laws Work?** ***IDEAS Working Paper Series from RePEc.*** **2014.**

Yörük and Yörük applied a regression discontinuity design to the National Longitudinal Survey of Youth 1997 cohort (NLSY97) data to estimate the potential impacts of minimum legal tobacco purchase ages in the United States. The NLSY97 is a national sample of 12 to 16 year olds (n=9,022). The authors note that the response rate is "quite high" but do not provide the exact number. Data were collected through annual personal interviews with the youth respondents. In the first year of the survey, one of the respondents' parents was also interviewed. The authors only included respondents who had been surveyed over the 1998 to 2004 period, who were up to two years older of younger than the minimum purchase age in their jurisdiction, and who were single as of the interview date. The researchers applied several models, and while some found significantly higher smoking rates among youth who had reached the minimum age, the authors conclude that their most robust model found that the higher smoking rates among youth over the minimum age compared to those younger than the minimum age were not significant. This model did, however, indicate that the probability of smoking for males and those who reported smoking before reaching the minimum purchase age was higher for those that had reached the minimum legal purchase age than for those who had not yet reached the minimum age. For those who had reported smoking before they reached the legal age, reaching the legal age was associated with a 5.1 percentage point increase in the probability of smoking recently, and a 24.7 percent increase in the number of days they smoked in the past month. The authors suggest that this indicates that youth who have not smoked by the minimum purchase

age are unlikely to start smoking when they reach that age, but those who have smoked before this age may increase their usage when they reach the minimum purchase age. For males, reaching the minimum purchase age was associated with a 3.1 percentage point increase in the probability of smoking, and a 10.4 percent increase in the average number of cigarettes smoked per day. The authors conclude that their models indicate that minimum purchase age policies are only effective in reducing smoking participation among certain groups (young males and youth who reported smoking at all before reaching the minimum purchase age). The authors note that their results can only be generalized to youth who are around the minimum purchase age and not to other age groups.

12. **Knox B. Increasing the Minimum Legal Sale Age for Tobacco Products to 21.: Campaign for Tobacco-Free Kids; 2016.**

In this report, the author presents an overview of the issues surrounding tobacco use among youth in the United States and outlines potential benefits to increasing the tobacco purchasing age to 21. Key points discussed include the modeling predictions from the 2015 Institute of Medicine report, tobacco company marketing towards youth, the success of raising the minimum drinking age to 21 and lessons learned, as well as the overall benefits to a Tobacco 21 approach.

13. **Pisinger Charlotta, Dossing Martin. A systematic review of health effects of electronic cigarettes. *Preventive Medicine.* 2014;69:248.**

Pisinger and Døssing conducted a systematic review of the literature on the health consequences of vaping products published before August 14, 2014. The authors identified 76 studies which met their inclusion criteria. They found that 34% of the studies' authors had a conflict of interest (e.g. the study was funded or somehow influenced by electronic cigarette manufacturers or consultants for manufacturers of medicinal smoking cessation therapy). Many studies found that product labels did not show the concentrations of solvents and flavoring and that products labeled nicotine free were sometimes found to actually contain nicotine in high concentrations. There was also variability in product concentrations from cartridge-to-cartridge. The authors conclude that the studies had many methodological problems and that the body of evidence is inconsistent, lack long-term follow up, and don't allow any firm conclusion on the safety of vaping products. They conclude that these 76 studies indicate that electronic cigarettes cannot be regarded as safe. The available evidence does indicate that at least some vaping products are toxic to human cells and contain toxic compounds such as metals, traces of carcinogenic nitrosamines, formaldehyde, mercury, and other potentially harmful components. Vaping was associated with significant airway and lung obstruction in the short term and other adverse effects in the mouth/throat. Some studies indicate that vaping may have less adverse effects or result in less exposure to harmful substances than combustible cigarettes. Some studies suggest that electronic cigarettes may be useful as a smoking reduction/cessation aid, but the evidence on their efficacy is conflicting.

14. **U.S. Department of Health and Human Services. The Health Consequences of Smoking: 50 Years of Progress. A Report of the Surgeon General. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, 2014. Printed with corrections, January 2014.**

The analysts writing the Surgeon General's reports on the health effects of smoking use a set of criteria to rank the strength of evidence that a causal relationship exits. For each health indicator, the analysts synthesize the evidence and then apply the criteria to the body of evidence. The report is then vetted by a series of external editors who are tasked with ensuring the accuracy of the report. This comprehensive analysis includes hundreds of references. The 2014 report concludes that since the 1964 Surgeon General's report, a very strong body of evidence has shown a causal link between cigarette smoking and diseases in nearly every organ, cancer (e.g. lung, liver and colorectal cancer), diminished health status, exacerbation of asthma, inflammation, impaired immune function, age-related macular degenera¬tion, harms to the fetus, diabetes, erectile dysfunction, arthritis, and premature death. Research also shows that secondhand smoke causes cancers, reparatory disease, cardiovascular disease, stroke, and harms to infant and child health. This report also summarizes the evidence indicating that tobacco use may have a different impact on adolescents than adults. The authors indicate that adolescence is a vulnerable stage of brain development, and that nicotine exposure during this age may have lasing adverse effects on brain development.

15. **QxQ Analysis: Smoking and Electornic Cigarette Use. 2016. http://www.askhys.net/Analyzer. Accessed January 18, 2018.**

Washington State Healthy Youth Survey data from 2016 indicate that among 8th grade respondents American Indian/Alaskan Native (AI/AN) students (6.8% [95% CI 3.5-10.1%%) and Black students (4.4% [95% CI 2.3-6.5%]) reported higher smoking rates than their Asian and Pacific Islander (API) (1.5% [95% CI 0.6-2.4%]), White (2.8% [95% CI 2.2-3.4%)], and Hispanic peers (3.1% (95% CI 2-4.2%). Among 10th grade respondents, the same trends held, with AI/AN (13% [95% CI 7.8-18.3]) and Black students (7.8% [95% CI 4.2-11.4%]) reporting higher smoking rates than their peers. The percent of students who had reported smoking at all in the past 30 days was highest among 12 grade respondents. AI/AN (18.3% [95% CI 12-24.6%]) and Black respondents (15% [95% CI 8.9-21.1%]) again reported higher smoking rates than their peers with 11.9% (95% CI 10-13.8%) of White youth smoking. These data suggest that in Washington State, AI/AN and Black youth have disparately high rates of current cigarette use across all grades. Students from the subsample of schools who participate in the extended form version of the Healthy Youth Survey also answered questions about their sexual orientation. Eighth grade respondents who identified as lesbian, gay, or bisexual were more likely to report smoking cigarettes at all in the last 30 days (10.2% [95% CI 5.7-14.7%]) than their peers who identified as straight (2.6% [95% CI 2-3.2%]). This disparity also existed among 10th graders (15.2% [95% CI 11.5-18.9%] vs. 4.9% [95% CI 4.1-5.7%]) and 12 graders (23.5% [95% CI 19.3-27.7%] vs. 9.3% [95% CI 7.4-11.2%]). When asked how many electronic cigarettes they had used in the past 30 days, Black (8.7 [95% CI 3.4-14%]) and AI/AN 8th graders (7.8% [95% CI 3.3-12.3%]) reported the highest usage. AI/AN reported teh highest useage among both 10th grade respondents AI/AN (22.6% [95% CI 14-31.2%]) and 12th grade respondents (18.3% [95% CI 12-24.6%]). It is important to note that the current race/ethnicity categories aggregate diverse subpopulations into one category—so disparities within these categories may be masked. For example, API subpopulations likely have very different smoking rates but they are aggregated into one category so these differences are missed.

16. **Lydon David M., Wilson Stephen J., Child Amanda, et al. Adolescent brain maturation and smoking: What we know and where we're headed. *Neuroscience and Biobehavioral Reviews.* 2014;45:323-342.**

Lydon et al. conducted a review of the literature on adolescent brain development and nicotine dependence. They cite evidence that smoking is most likely to be initiated during adolescence and that most adults who smoke daily initiate smoking by 18 years of age. The authors also note that once adolescents begin smoking, they are more likely than adults to continue smoking because they experience heightened positive effects from nicotine and are more susceptible to developing nicotine addiction than adults. Research also indicates that individuals who smoked their first cigarette at a younger age and who had a more pleasant experience are more likely to smoke additional cigarettes. Early-initiation smokers also tend to develop nicotine dependence faster and have higher daily cigarette consumption rates than later-initiation smokers. The authors cite a 1996 study by Breslau and Petterson which found that early smoking onset is associated with decreased likelihood of cessation. The likelihood of quitting was lowest for youth who initiated smoking at 13 or younger, with likelihood of quitting increasing with each year that initiation was delayed for adolescents.

17. **Christenson T., Weisser, J. Health of Washington State Report: Tobacco Use. Washington State Department of Health; 2015.**

Combined 2012-2014 Behavioral Risk Factor Surveillance System (BRFSS) data indicate that AI/AN adults in Washington have significantly higher rates of current cigarette use than their White, Black, Hispanic/Latino, and Asian counterparts. Cigarette use also decreased significantly as educational attainment or income increased. This report also indicates that smoking rates among gay, lesbian, and bisexual respondents were significantly higher than for their straight counterparts. These BRFSS data and 2014 Healthy youth survey data also show that smoking prevalence is highest in late adolescence and early adulthood, peaking among 25-34 years old for men and women. Pregnancy Risk Assessment Monitoring System (PRAMS) data from 2010-2012 indicate that the smoking rates among pregnant women before and during pregnancy are highest among mothers younger than 20 (36% [95% CI 28-45%]). Thirty-two percent of mothers age 20-24 also reported smoking before and during pregnancy (95% CI 27-37%) compared to 9% (95% CI 6-12%) of mothers 35 years or older. These data also indicate that smoking before pregnancy is highest among AI/AN (50% [95% CI 45-55%]) and low-income mothers. Because women often are not aware that they are pregnant until several weeks into their pregnancy, the smoking rates in the months leading up to pregnancy can have an important impact on fetal development and growth.

18. **Hocharoen Chanalee. An evaluation of potential harm of electronic cigarette aerosol exposures and directions for research and regulation. In: Taft D, ed: ProQuest Dissertations Publishing; 2015.**

Hocharoen conducted a systematic review of the literature on electronic cigarettes published between January 1, 2009 and January 31, 2015 in academic journals. Thirty-nine articles met the inclusion criteria. Three of these studies examined inflammatory markers, cytokines, and chemokines, all of which found that interleukins (cellular messengers for immune response) increased with electronic cigarette exposure. One study found that interleukin 6 decreased with e-cigarette exposure. Seven studies examined cytotoxicity (cell toxicity) or mutagenicity (ability

to cause genetic mutations). These studies looked at the impacts of e-vapors of liquids on lung, throat, and mouth specific embryonic stem cells, and various fibroblasts. Six of these seven studies found cytotoxic effects, decreased cell viability, changes in cell morphology, reduced ATP detection, and cell mutagenicity for at least one of the measured flavors or e-liquid components. The seventh study found no cytotoxicity from e-liquids for epithelial carcinoma cells or Chinese Hamster ovary cells. The author concludes that cell viability is affected by e-cigarettes and that vapor products sometimes contain "carcinogens, metals, and other potentially harmful constituents." The author notes that while physiological effects of e-cigarettes have been found in the literature, potential adverse long-term effects have not been studied.

19. **Services U.S. Department of Health and Human. E-Cigarette Use Among Youth and Young Adults: A Report of the Surgeon General. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office of Smoking and Health; 2016.**

This report was prepared by the Office on Smoking and Health, National Center for Chronic Disease Prevention and Health Promotion, CDC with a focus on examining the research around the epidemiology and health effects of e-cigareete use among youth and young adults in the United States. "The initial drafts of the chapters were written by 27 experts who were selected for their knowledge of the topics addressed. These contributions are summarized in five chapters that were evaluated by approximately 30 peer reviewers. After peer review, the entire manuscript was sent to more than 20 scientists and other experts, who examined it for its scientific integrity." The chapters outline the following topic areas: (1) historical background, (2) patterns of e-cigarette use among U.S. youth and young adults, (3) health effects of e-cigarette use among U.S. youth and young adults, (4) activities of e-cigarette companies, and (5) e-cigarette policy and practice implications.

20. **Gmel Gerhard, Baggio Stéphanie, Mohler-Kuo Meichun, et al. E- cigarette use in young Swiss men: is vaping an effective way of reducing or quitting smoking? *Swiss medical weekly.* 2016;146:w14271.**

Gmel et al. summarize the current evidence on the impact of e-cigarettes on combustible cigarette usage, noting that the literature is conflicting—with some studies finding that vaping is associated with using fewer cigarettes but with being less likely to completely quit smoking combustible cigarettes, other studies finding an increase in combustible cigarette usage and decreased likelihood of quitting, and still other studies finding that e-cigarettes were associated with more quit attempts and continued abstinence than NRT or using no aid. The authors used data from the Cohort Study on Substance Use Risk Factors in Switzerland. While 7,556 participants (all young men) provided consent to participate, 79.2% (n=5,987) completed the baseline questionnaire and 79.7% (n=6,020) completed the follow-up questionnaire. A total of 91.5% of the baseline respondents (n=5.476) also completed the follow-up questionnaire. Among those who did not smoke at baseline, those who were vaping at follow-up were more likely to start smoking and to become occasional or daily smokers at follow-up than were nonvapers. Among those who were occasional smokers at baseline, nonvapers were more likely to become nonsmokers and less likely to become daily smokers than vapers. Among those who did not smoke at baseline, vapers were 6 times more likely to be occasion smokers and 12 times more

likely to be daily smokers at follow-up than nonvapers. Among nonsmokers at baseline, vapors smoked significantly more (10 times more) cigarettes weekly at follow-up then did nonvapers. Weekly cigarette use increased between baseline and follow-up for occasional smokers and decreased for daily smokers but these changes were not significantly between vapers and nonvapers.

21. **Grace Randolph C., Kivell Bronwyn M., Laugesen Murray. Estimating cross- price elasticity of e- cigarettes using a simulated demand procedure.** ***Nicotine & tobacco research : official journal of the Society for Research on Nicotine and Tobacco.*** **2015;17(5):592.**

Grace et al. collected data from a convenience sample of 210 daily smokers in New Zealand who were 18 years of age or older and who had no intention to quit smoking before January 1, 2013. They excluded any smokers who had ever used e-cigarettes. They interviewed participants between February and March of 2013 (response rate not noted). The researchers had participants complete a written survey and three addition validated surveys, complete the Cigarette Purchase Task (CPT), sample an e-cigarette, and then answer questions about their intentions to purchase e-cigarettes and their regular tobacco product. The CPT is used to measure demand for tobacco products across a range of prices. The authors used the CPT completed before sampling the e-cigarette as a baseline to determine the demand for combustible cigarettes in the absence of e-cigarettes. The participants also indicated their intentions to purchase e-cigarettes and combustible cigarettes after trying the e-cigarette. The authors found that the simulated demand for e-cigarettes increased as the price of regular cigarettes increased, with an average cross-price elasticity of 0.16 (indicating that a 10% increase in the cost of combustible cigarettes was associated with a 1.6% increase in the demand for e-cigarettes). However, the simulation also found that the low-cost availability of e-cigarettes did not decrease the demand for regular cigarettes at a higher price and that a significantly lower proportion of participants said that they would quit smoking tobacco completely if e-cigarettes were available than if they were not. This finding suggests that the availability of low-priced e-cigarettes could actually encourage people who would otherwise have quit smoking completely as a result of raising tobacco prices to instead continue to use combustible cigarettes perhaps in tandem with lower-cost e-cigarettes. So, while the study found that smokers may substitute e-cigarettes for combustible cigarettes as the cost of the later increases (with the cost of the former staying low), low-cost e-cigarette availability may actually discourage combustible cigarette smokers from quitting entirely as combustible cigarette prices increase.

22. **Rahman M. A., Hann N., Wilson A., et al. E- Cigarettes and Smoking Cessation: Evidence from a Systematic Review and Meta- Analysis.** ***PLoS One.*** **Vol 102015.**

Rahman et al. conducted a systematic review of the literature on combustible cigarette consumption or cessation after the use of e-cigarettes. Six studies met their inclusion criteria. They found that e-cigarettes with nicotine were more effective as a cessation tool than those without nicotine. The authors pooled data from two randomized control trials and found a risk ratio of 2.29 (95% CI 1.05-4.97). They also found that use of e-cigarettes was associated with smoking cessation and reduction in the number of cigarettes used—though three of the six studies did not include a control group. The authors note that they were only able to consider the efficacy of nicotine vs. non-nicotine e-cigarettes and were not able to compare the efficacy of e-cigarettes to other cessation interventions.

23. **Kalkhoran Sara, Glantz Stanton A. E-cigarettes and smoking cessation in real-world and clinical settings: a systematic review and meta-analysis. *The Lancet Respiratory Medicine.* 2016;4(2):116-128.**

Kalkhoran et al. conducted a systematic review and meta-analysis to evaluate the association between e-cigarette use and combustible cigarette cessation among adults. Thirty-eight studies met their inclusion criteria for the systematic review, 20 of which had control groups and were included in the meta-analysis. They found that the odds of combustible cigarette cessation among those who used e-cigarettes was 28% lower than for those who did not use e-cigarettes (OR 0.72 [95% CI 0.57-0.91]). When the authors only included studies of smokers with an interest in quitting, they did not find a significant difference from the overall findings. The authors conclude that e-cigarettes, as they are currently being used, are associated with lower quit rates among combustible cigarette smokers.

24. **Leventhal Adam M., Strong David R., Kirkpatrick Matthew G., et al. Association of electronic cigarette use with initiation of combustible tobacco product smoking in early adolescence.(Report). 2015;314(7):700.**

Leventhal et al. cite evidence that electronic cigarettes are being used among teens who have never used combustible cigarettes. They cite a 2014 estimate that in the United States 43% of 10th graders who reported using e-cigarettes in the previous 30 days reported never having tried combustible cigarettes. Leventhal et al. analyze data from a longitudinal survey of high school students from a convenience sample of 10 public high schools in the Los Angeles, California area. They collected data in three waves: baseline (fall 2013; 9th grade), 6-month follow-up (spring 2014), and 12-month follow-up (fall 2014; 10th grade). The final sample included students who completed all three waves of the survey (n=2,530). They found that students who reported e-cigarette use at baseline were also more likely to report use of combustible tobacco products in the previous 6 months. After adjusting for potential confounding factors, the authors found that baseline e-cigarette use was also associated with a higher likelihood of using combustible tobacco products (cigarettes, cigars, or hookah) at follow-up (averaged across the two follow-up periods OR 2.73 [95% CI 2.00-3.73]). This trend was also true for combustible cigarettes specifically (OR 3.25 [95% CI 2.29-4.62]).

25. **Thomas A Wills, Rebecca Knight, James D Sargent, et al. Longitudinal study of e-cigarette use and onset of cigarette smoking among high school students in Hawaii. *Tobacco Control.* 2016.**

Wills et al. analyzed 2013 and 2014 longitudinal school-based survey data from Hawaii. The baseline sample included 2,338 9th and 10th graders. Students who were not smokers at baseline but who had used e-cigarettes were significantly more likely to have smoked combustible cigarettes at the one-year follow-up than their non-smoking peers who had never tried e-cigarettes (OR 2.87 [95% CI 2.03-4.05]). Among students who had tried combustible cigarettes at baseline, using e-cigarettes was not significantly related to changes in their frequency of smoking traditional cigarettes at follow-up.

26. **Thompson A. B., Mowery P. D., Tebes J. K., et al. Time Trends in Smoking Onset by Sex and Race/Ethnicity Among Adolescents and Young Adults: Findings From the 2006-2013 National Survey on Drug Use and Health.** ***Nicotine Tob Res.*** **2017.**

Thompson et al. (2017) analyzed data from the 2006 to 2013 National Survey of Drug Use and Health to analyze trends in smoking onset among different age and racial and ethnic groups. Data from approximately 180,000 adolescents and young adults were included in the study. Specifically, the researchers looked at the change in rate of smoking onset over time, differences in rate between adolescents and young adults, and differences in rate by sex and race and ethnicity. The researchers found that the average age of smoking onset was 17.7 years. Overall, the rate of smoking onset declined across all age groups. However, the rate of the decline was not constant across all demographic groups. Black and Hispanic males had higher rates of onset than their White peers, and the rate of onset was higher among young adults aged 18 to 25 years compared to adolescents aged 12 to 17 years. In addition, the study found that women were more likely than men to initiate smoking as young adults, especially Black and Asian females. The researchers note that findings from the study suggest that prevention efforts should focus on young adults, and that reducing onset of smoking among young adults may improve smoking-related health outcomes later in adulthood, especially for racial and ethnic minority communities.

27. **Roberts M. E., Spillane N. S., Colby S. M., et al. Forecasting Disparities with Early Substance-Use Milestones.** ***J Child Adolesc Subst Abuse.*** **2017;26(1):56-59.**

Roberts et. al. (2017) collected demographic information from 917 12-year olds attending six middle schools in Rhode Island. They followed up with these students semi-annually and after three years to determine if they had ever tried alcohol, cigarettes, or marijuana. Students self-reported race and ethnicity. Parents provided information about annual household income, highest level of educational attainment, and whether their family qualified for free or reduced-price lunches. This information was combined to determine socioeconomic status. The researchers found significant differences in initiation of cigarette use based on socioeconomic status and race and ethnicity. Native American and multiracial youth were most likely to initiate cigarette use at an early age. The authors noted that these group-based differences in smoking initiation were concerning since these communities also experience differences in substance use and health disparities in adulthood.

28. **Task Force on Race and the Criminal Justice System. Juvenile Justice and Racial Disproportionality: A Presentation to the Washington Supreme Court. 2012.**

This report by Washington's Task Force on Race and the Criminal Justice System highlights data which indicate that youth of color in Washington are over-represented at every stage of the juvenile justice system. For example, youth of color are more likely than their white peers to be arrested, referred to court, prosecuted, adjudicated guilty, incarcerated, and transferred to the adult system.

29. **London Andrew, Myers Nancy. Race, Incarceration, and Health.** ***Research on Aging.*** **2006;28(3):409-422.**

London and Myers conducted a review of the literature around health and other outcomes for incarcerated individuals. They highlighted research that indicates that black Americans have

worse health outcomes than other racial/ethnic groups, and also are disproportionately represented in the justice system. The authors also outlined data indicating the high rates of injury in jails and prison as well as the high rates of communicable disease among incarcerated and formerly incarcerated individuals. In addition, they highlight research that indicates that incarceration is associated with lower educational attainment, lower income, higher rates of unemployment, and higher involvement in jobs with high risk of injury or exposure to hazardous working conditions. Evidence also indicates that incarceration is associated with divorce and separation of families.

30. **Murray J., Farrington D. P., Sekol I. Children's antisocial behavior, mental health, drug use, and educational performance after parental incarceration: a systematic review and meta-analysis.** ***Psychological bulletin.*** **2012;138(2):175-210.**

Murray et al. conducted a systematic review and meta-analysis of the literature on parental incarceration and impacts on children's later mental, emotional, and social health. They identified 40 studies that met their strict inclusion criteria. The researchers pooled the odds ratios across all samples in order to determine if children with incarcerated parents had a greater risk of each outcome than children in the control group who did not have an incarcerated parent or parents. These pooled odds ratios indicated that parental incarceration was significantly associated with antisocial behavior among their children even after controlling for covariates. In some subpopulations parental incarceration was significantly associated with children's poor academic performance, poor mental health, and drug use, but this association was not significant for every subpopulation and did not always remain significant after controlling for covariates.

31. **Roettger Michael E., Boardman Jason D. Parental Incarceration and Gender-based Risks for Increased Body Mass Index: Evidence From the National Longitudinal Study of Adolescent Health in the United States.** ***American Journal of Epidemiology.*** **2012;175(7):636-644.**

Roettger et al. analyzed data from the National Longitudinal Study of Adolescent Health (1994–2008). The dataset included 15,558 individuals who had completed interviews for all waves of the study, including 1,205 males and 1,472 females who reported that their biologic mother or father was incarcerated. The researchers found that females who had experienced a parent being incarcerated saw greater increase in Body Mass Index (BMI) over time for than did females whose parents had not been incarcerated. This trend remained significant even after controlling for stressful life events, internalizing behaviors, and a range of individual, familial, and neighborhood characteristics.

32. **Swisher Raymond R., Roettger Michael E. Father's Incarceration and Youth Delinquency and Depression: Examining Differences by Race and Ethnicity.** ***Journal of Research on Adolescence.*** **2012;22(4):597-603.**

Swisher and Roettger analyzed data from the in-home portion of the National Longitudinal Study of Adolescent Health. Due to insufficient sample size for other racial/ethnic groups, only white, black, and Hispanic respondents were included in this study. The researchers found that among all racial/ethnic groups father's incarceration is associated with increased depression and delinquency for the children, even after controlling for other variables such as demographics and family background measures. In addition, when considering these results by race/ethnicity, the

data indicate that among Hispanic respondents, having their father incarcerated is associated with a higher propensity for delinquency than among white and black respondents.

33. **Turney K., Wildeman C., Schnittker J. As fathers and felons: explaining the effects of current and recent incarceration on major depression. *Journal of health and social behavior.* 2012;53(4):465-481.**

Turney et al. analyzed data from the longitudinal Fragile Families and Child Wellbeing study. The researchers found that currently and recently incarcerated fathers are more likely to report a change in employment status, separation from a child's mother, a change in relationship quality, and depression. The association between incarceration and depression remained significant even after controlling for variables such as demographic characteristics and history of depression.

34. **Wu E., El-Bassel N., Gilbert L., et al. Prior incarceration and barriers to receipt of services among entrants to alternative to incarceration programs: a gender-based disparity. *Journal of urban health : bulletin of the New York Academy of Medicine.* 2012;89(2):384-395.**

Wu et al. collected data from a random sample of adults (N=322; 83 women and 239 men) entering alternative to incarceration programs in New York City. Researchers collected data though structured interviews including information on sociodemographics, substance use, prior incarcerations, and barriers that had prevented a participant from visiting or returning to a service provider. Less than half of the participants had earned a high school diploma or GED. When analyzing collapsed data for male and female participants, they found that a greater number of prior incarcerations were significantly associated with a greater number of barriers that prevented accessing a service provider. When they analyzed the data disaggregated by sex and controlling for sociodemographic and substance use indicators, researchers found that the relationship between a greater number of prior incarcerations and greater number of service barriers experienced remained significant only for men.

35. **Day J. K., Fish J. N., Perez-Brumer A., et al. Transgender Youth Substance Use Disparities: Results From a Population-Based Sample. *J Adolesc Health.* 2017;61(6):729-735.**

Day et al. (2017) completed a cross-sectional, population-based, representative analysis of substance use among transgender and nontransgender middle and high school students in California. Data was collected as part of the 2013-2015 Biennial Statewide California Student Survey. The sample included 32,072 middle and high school students from across California (71% response rate). Of these students, 335 self-identified as transgender. The sample of students were representative of the California population as a whole. Day concluded that transgender students were 2.5 to 4 times more likely to use tobacco, marijuana, alcohol, and other illicit drugs compared to nontransgender students. For tobacco, approximately 35% of transgender youth reported ever smoking cigarettes. Transgender youth were 2.7 times more likely to have ever smoked cigarettes and 4.2 times more likely to have used cigarettes in the past 30 days compared to nontransgender youth. In addition, transgender students were more likely to have started using cigarettes at an early age and were at higher risk for ever using cigarettes than their nontransgender peers. The increased likelihood of substance use among transgender youth was partially mediated by victimization, mental health, and perceived risk of substance use.

Victimization significantly mediated the relationship between gender identity and cigarette use. The authors noted that the study was limited by the measure of gender identity, and by the fact that this analysis was cross-sectional.

36. **Prevention Centers for Disease Control and. Burden of Tobacco Use in the U.S.: Current Cigarette Smoking Among U.S. Adults Aged 18 Years and Older. 2017.**

Evidence indicates that, nationally, cigarette use is higher among active military personnel than among the civilian population. Prevalence of cigarette use is even higher among military personnel who have been deployed. United States data for men from 2007 to 2010 from the National Health Interview Survey indicate that male veterans are significantly more likely than non-veterans to be current smokers in every age group.

37. **Behavioral risk factor surveillance system prevalence and trends data: Washington-2011. 2011; Available at: http://apps.nccd.cdc.gov/brfss/page.asp?cat=XX&yr=2012&state=WA#XX. Accessed November 14, 2015.**

Behavioral Risk Factor Surveillance System data from 2011 indicate that young adults of color experience worse health outcomes than their white counterparts on a number of health indicators. While there were too few respondents in this age category to report rates at the state level, nationally these data indicate that black respondents between the ages of 18 and 24 were significantly more likely than white respondents to report that frequent poor physical or mental health prevented them from doing their usual activities. These rates were also higher for Native Hawaiian and other Pacific Islander, American Indian/Alaska Native (AI/AN), and Hispanic participants as well as those that reported multiple races or "other race," however these differences did not reach statistical significance using one year of data. In addition, BRFSS data indicate that a similar number of veteran respondents and non-veteran respondents report currently smoking cigarettes. The rate for veterans is 17.1% (95% CI 14.3-19.9%) and the rate for non-veterans is 17.6% (95% CI 16.4-18.8%). Some of the most vulnerable veterans (e.g. those experiencing homelessness) may not be reached by this telephone survey. Among all respondents, 17.5% (95% CI 16.4-18.6%) reported currently smoking cigarettes.

38. **Defense Department of. 2011 Health Related Behavior Survey for Active Duty Service Members. 2011.**

Health Related Behavior Survey data for Active Duty Service Members is a Department of Defense Survey used to track health indicators for the military. Survey data from 2011 indicate that 18% of respondents reported smoking in the past 30 days. Thirsty-seven percent indicated that they had smoked in their lifetime, and 19% indicated that they were former smokers.

39. **Smith Elizabeth A., Walker S. Poston, Sara A. Jahnke, Nattinee Jitnarin, Christoper Haddock, Ruth Malone. United States Military Tobacco Policy Research: A White Paper. University of California San Francisco and National Development and Research Institutes, Inc.; 2016.**

This report was funded by the National Institutes of Health, and completed by University of California San Francisco. It summarizes current tobacco use among members of the U.S. military

and provides an overview of current military tobacco policy. The report states that high smoking prevalence among U.S. military personnel results in training injuries, premature discharge, lower cardiovascular and respiratory health, reduced troop readiness, and high costs for the Department of Defense. Specific to Tobacco 21 laws, this report states that the U.S. Navy decided to comply with Hawaii's Tobacco 21 policy and supported California's efforts to increase the minimum age of purchase. California exempted military personnel from their Tobacco 21 laws.

40. **Winickoff Jonathan P., Hartman Lester, Minghua L. Chen, et al. Retail impact of raising tobacco sales age to 21 years.(Report).** ***The American Journal of Public Health.*** **2014;104(11):e18.**

Winickoff et al. cite evidence that: 59% of 18 and 19 year olds have been asked by a younger person to buy cigarettes for them; high-school students are less likely to have social connections with adults over 20 than with 18 to 20 year olds; almost 90% of smokers nationally began smoking before the age of 21; others have estimated that raising the tobacco sale age to 21 could reduce tobacco use by 55% for 15 to 17 year olds within seven years. The authors analyzed 2011 National Health Interview Survey data (n=33,014) in order to determine the proportion of current legal tobacco sales that are made by (or for) 18 to 20 years olds to estimate the potential impact on retailers if the sale age is increased to age 21. They make the assumption the law would be universally implemented and enforced. These data show that 18 to 20 year olds make up 3.06% of the total adult smoking population and account for 2.12% of cigarette consumption. The authors use these figures to estimate that the immediate loss of sales would be about 2% of total cigarette sales nationally. Then, assuming that the policy would have a long-term impact on smoking rates of adults in the future (through the aging of this low tobacco-use cohort), this could lead to a gradual reduction in the sale of cigarettes to older adults over time. This analysis only made predictions about combustible cigarette sales and not about other tobacco or vaping products. The authors also note that no tobacco retailers have gone out of business in Needham Massachusetts since it implemented a tobacco 21 purchase age in 2005. This study was funded by the National Institute of Health, National Cancer Institute, National Institute on Drug Abuse, and the Agency on Healthcare Research and Quality. The authors note that the funders played no role in the design or execution of the study, analysis of the data, or review and approval of the article.

41. **Silver D., Macinko J., Giorgio M., et al. Retailer compliance with tobacco control laws in New York City before and after raising the minimum legal purchase age to 21.** ***Tob Control.*** **2016;25(6):624-627.**

Researchers in New York City compared retailer compliance with tobacco control laws before and after the city passed their Tobacco 21 policy in 2014. With the passage of Tobacco 21, New York City raised the purchase age for tobacco from 18 to 21, required retailers to post a new sign about the legal age for purchase as well as a sign showing the new tax stamp, and required retailers to adhere to a new minimum sales price. The Tobacco 21 law did not provide any additional funding to ensure retailer compliance. This study looked at compliance for all four provisions before and after the passage of the law. Researchers trained youthful, racially diverse, female field officers to complete compliance checks at tobacco retailers located in easily accessible, retail dense areas of the Bronx, Brooklyn, Manhattan, and Queens. Field officers visisted retail stores twice before and twice after the Tobacco 21 laws went into effect. They

assessed whether retailers requested ID, posted a sign about the legal age for purchase and the new tax stamp, and complied with minimum sale price laws. The study concluded that retailer compliance actually decreased after the Tobacco 21 law went into effect, and that retailer compliance with ID checks significantly decreased from 71% to 62%. They also found a decrease in the percent of retailers complying with minimum sale price laws. Data showed that chain retail stores were more likely than independent retailers to comply with Tobacco 21 laws. Overall, the study concluded that retailers that followed other tobacco sales regulations were also more likely to check ID during sale of tobacco.