DOI: 10.32481/djph.2020.08.019

Vaping Among Delaware Youth

Rachel Ryding;[1] David Borton, MA;[2] Meisje Scales, MPH, CPS;[3] Dana Carr, MPH;[4] Helen Arthur, MHA;[5] Lisa M. Moore, MPA;[6] Sharon Merriman-Nai, MC[7]

1. Research Assistant, Center for Drug and Health Studies, University of Delaware

2. Research Associate, Center for Drug and Health Studies, University of Delaware

3. Research Associate, Center for Drug and Health Studies, University of Delaware

4. Senior Advisor for Prevention and Health, Delaware Division of Substance Abuse and Mental Health (DSAMH), Department of Health and Social Services

5. Section Chief, Health Promotion and Disease Prevention, Delaware Division of Public Health, Department of Health and Social Services

6. Director, Tobacco Prevention and Control Program, Delaware Division of Public Health, Department of Health and Social Services

7. Senior Consultant, Center for Drug and Health Studies at the University of Delaware

Introduction

Recent years have seen the rise of a new substance, the use of which has yet-unknown long-term consequences. Known colloquially as e-cigarettes, e-cigs, or vaping devices, usage rates have grown exponentially throughout the country over the past decade with increases seen across every demographic group. National Monitoring the Future data from 2019 shows that 25% of 12th graders report having vaped nicotine in the past month, an increase from 11% in 2017,[1] and the 2019 National Youth Tobacco Survey estimates that over five million youth are currently using e-cigarettes.[2]

Vaping takes a number of forms and vaping equipment can be purchased under a number of different names. Some may know vaping devices as e-cigarettes, while others know them as mods; yet others may know them only under a particular brand name such as the extremely popular JUUL. The core of vaping is this: a heating element heats a liquid, turning it into aerosol, which is then inhaled. These liquids can contain a variety of ingredients. Many – but not all – vaping liquids double as tobacco products because they contain nicotine, a tobacco derivative. Other vaping liquids are marijuana-based products; they contain Tetrahydrocannabinol (THC). A common ingredient in vaping liquids is flavoring.[3] Hundreds of other flavors are available through third party brands and vape shops can also prepare customized blends of liquid nicotine, flavors, and other liquids for consumers.[4]

Because vaping devices and products (flavors, liquids, etc.) are not held to the same advertising restrictions as tobacco, vaping is promoted through all traditional advertising mediums including television, print, and web ads. These ads often feature celebrities and are designed to make vaping appear safe yet "cool." JUUL, which had, until recently, marketed a number of flavors such as Mango and Mint, became the fastest company ever to exceed $10 billion valuation in 2018, largely due to its appeal to youth.[5] A Surgeon General's report suggests that advertising for vaping devices will follow a trend similar to that of cigarettes, leading young people to believe that vaping is normal and acceptable.[6] Researchers from the Stanford University Research into the Impact of Tobacco Advertising (SRITA) group found that, despite the

company's claims that they targeted their products to adult smokers, JUUL's initial marketing campaigns were "patently youth oriented," employing social media influencers and other figures popular with youth to post about JUUL online.[7] Even after the company halted its official social media advertising in late 2018, the product and cult following had become so popular that young users themselves continued to promote JUUL products on social media at an even higher rate than before.[8]

Although it is marketed as a safe alternative to smoking, or a strategy to quit smoking, there is limited research to support this claim. Nicotine, in particular, is unsafe to anyone under the age of 25 due to the harm it causes to the developing brain.[6] Vaping nicotine is also associated with use of other drugs; specifically, those who vape are much more likely to start using other tobacco products than those who do not vape.[6] Some products deliver high concentrations of nicotine which can lead to addiction. In some cases, vaping devices have exploded, causing facial injuries to the user.[9] Because vaping is relatively new, the potential long-term effects related to the aerosolizing process are still being researched. In addition to potential chronic impacts, the Centers for Disease Control and Prevention (CDC), Food and Drug Administration (FDA), and other health officials have been investigating an outbreak of e-cigarette or vape product use-associated lung illnesses, known as EVALI. Although they are currently on the decline, as of February 2020 the CDC reported a total of 2,807 cases of EVALI, including 68 confirmed deaths throughout 29 states and Washington, D.C. Vitamin E acetate, an additive found in some THC-containing vape products, appear strongly linked to EVALI, but the CDC warns that there is not enough evidence to rule out the potential impact of other substances.[10]

Delaware is no exception to the rising popularity of vaping. Youth survey data indicates that vaping rates continue to climb among Delaware students although rates of cigarette smoking continue to decline. Not only is vaping a concern as a risk behavior in and of itself, but consumption of one substance is frequently associated with increased likelihood for use of other substances.[11] Known health risks associated with vaping, unknown risks of long-term use and exposure, and increased risk for polysubstance use converge to create an escalating public health concern.

This article provides an overview of vaping among Delaware high school students by exploring the findings of several statewide data sources. We consider the implications of the data, then highlight several policies and promising practices currently underway to address the increasingly prevalent behavior.

Youth Data Collection Efforts

The Center for Drug and Health Studies at the University of Delaware (CDHS) partners with various State agencies and organizations on research related to substance use, health risk behaviors, and health policy. CDHS conducts several youth surveys which yield data on risk and protective factors regarding wellbeing and behavioral health. On behalf of the Delaware Division of Substance Abuse and Mental Health (DSAMH), CDHS administers the annual Delaware School Survey (DSS). On behalf of the Division of Public Health (DPH), a sister agency to DSAMH in the Delaware Department of Health and Social Services, the Center administers the Delaware High School Youth Risk Behavior Survey (YRBS) and the Youth Tobacco Survey (YTS) biennially in alternating years. Along with the State Epidemiological Outcomes Workgroup (SEOW), a network that promotes the strategic use of data for prevention efforts (also facilitated by CDHS on behalf of DSAMH), these data sources provide the capacity to

monitor experiences and attitudes of Delaware youth. The current study examines vaping and associated data from these surveys.

The Delaware School Surveys (DSS)

Administered by CDHS since 1995 with support from State agencies (most recently DSAMH and allocations from the Master Tobacco Settlement), the DSS is designed to collect data regarding substance use, delinquency, risk, and protective factors. There are two versions. The 5th grade questionnaire is designed for younger students and is much briefer than the secondary questionnaire that is administered to 8th and 11th graders. CDHS updates the DSS annually with input from an advisory committee of State and community stakeholders and attempts to engage participation from all public schools throughout Delaware. The annual sample size for the 11th grade is approximately 3,000 - 4,000 students. To decrease survey burden, DSS administration excludes those classes randomly selected to participate in two alternating CDC surveys, the Youth Risk Behavior Survey (YRBS) and the Youth Tobacco Survey (YTS) subsequently described. The secondary DSS includes several questions about students' vaping behaviors and attitudes, such as the frequency with which students vape, what types of products they vape, and whether students find vaping to be risky. The DSS also asks about students' relationships with their parents, their sense of connectedness with their school, whether they engage in externalizing behaviors such as assault or property damage, and demographic questions.

Delaware Youth Risk Behavior Survey (YRBS)

The purpose of the YRBS is to assess the prevalence of health risk behaviors, identify behavior trends, and improve and inform programs and policies related to youth. The survey was developed in 1990 by the CDC. The CDC conducts a national survey biennially and supports states, large urban regions, tribal organizations, and territories interested in administering the high school survey.[12] (The CDC has also develops a middle school survey but relatively few states elect to participate; it has been fielded in Delaware with support from nonprofit and State agencies, most recently from the Department of Services for Children, Youth, and their Families Division of Prevention and Behavioral Health Services.) Through 2019, the YRBS has been administered to students in a randomly selected sample of classes from a census of Delaware public high schools. CDHS customizes a Delaware version of the survey in collaboration with the Division of Public Health and with input from the same advisory group that informs the annual DSS development. In addition to providing data on substance use, the YRBS also provides statewide youth data on health, diet, and sexual activity, as provides comparability to other states' findings published by the CDC in the Morbidity and Mortality Weekly Report. In 2017, 41 high schools participated, providing a total of 2,933 survey responses in the final dataset.

Youth Tobacco Survey (YTS)

Delaware's Tobacco Prevention and Control Program sponsors the YTS in even-numbered years. The YTS is a collaborative effort of the Delaware Division of Public Health and the CDC and provides data for planning, implementation, and evaluation of effective programs to prevent and reduce tobacco use in Delaware. In recent years, the YTS has included questions related to vaping. The survey is administered by CDHS to students from a random sample of 6th through 12th grade classes in randomly selected public schools in Delaware.

DOI: 10.32481/djph.2020.08.019

The DSS, YRBS, and YTS are voluntary and completed anonymously by students. Parents are notified by letters distributed by school personnel and passive parental permission is obtained prior to survey administration. In addition, students have the right to decline to participate at the time of administration, which is conducted at schools by experienced survey administrators hired and trained through CDHS. Surveys are approved by the University of Delaware Institutional Review Board prior to each cycle of administration. (Additional information is available on the School Surveys page of the CDHS website.)

Select variables from each survey are described and analyzed in the following section.

What We Can Learn from the Data About Youth Vaping in Delaware

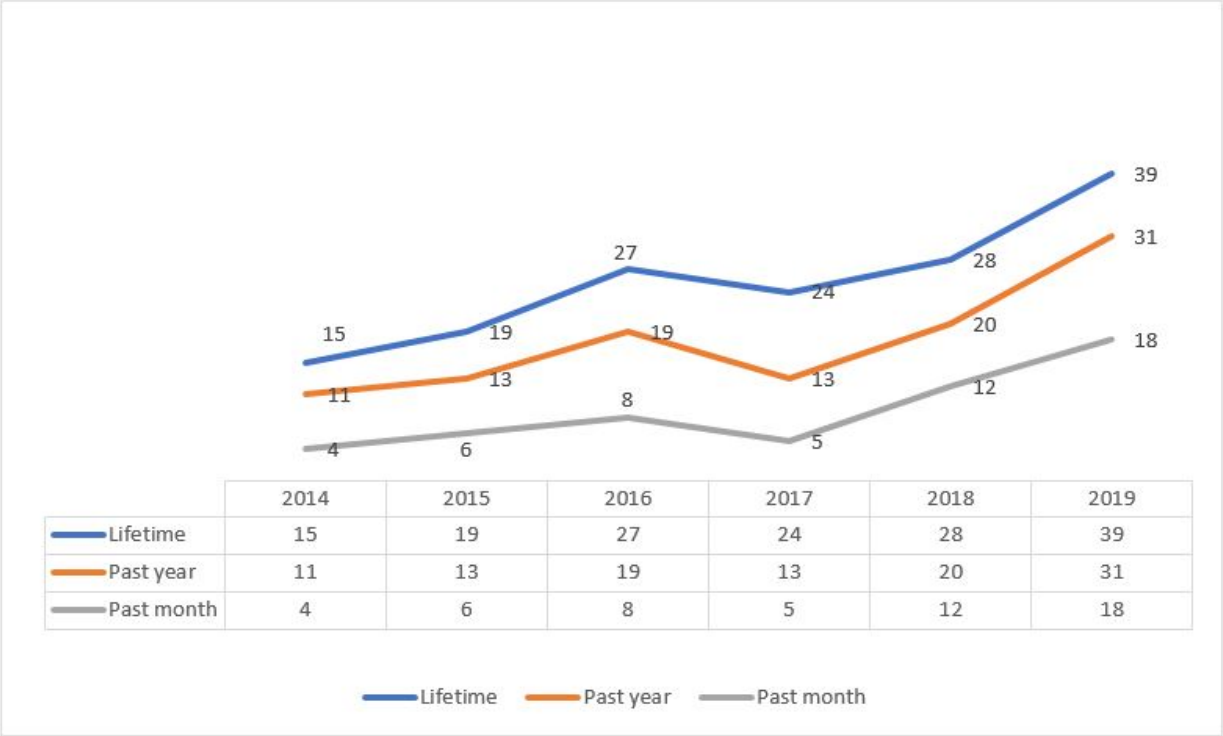
Rate of Vaping and Related Behaviors

Since 2014, the DSS has included questions regarding use of e-cigarettes. In 2014, the question asks how often students used *e-cigarettes* with six possible responses: never; before, but not in the past year; a few times in the past year; once or twice a month; once or twice a week; or almost every day. In the 2016 survey, this question was expanded to ask students how often they used e-cigarettes or *vaping devices*. In 2017, this question was split into two distinct questions, one that asked only about e-cigarettes and one that asked only about other vaping devices. In the 2018 and 2019 surveys, a third question was added to the DSS to specifically ask students how often they used *JUUL* devices as well due to its increase in popularity.

The past five years of available data from the DSS illustrate sharp increases in the percentage of students who report ever vaping in their lifetime, in the past year, and in the past month. From 2014 to 2019, the self-reported past month use of any vaping devices (calculated by combining responses from students who used any e-cigarette, JUUL, or other vaping device almost every day, once or twice a week, or once or twice a month) among surveyed 11th grade students in Delaware more than tripled, increasing from 4% to 18%, with parallel increases in past year and lifetime use (see Figure 1).

Figure 1. Vaping trends among Delaware 11th grade students (%) Delaware School Survey (DSS, 2014-2019).

DOI: 10.32481/djph.2020.08.019



	2014	2015	2016	2017	2018	2019
Lifetime	15	19	27	24	28	39
Past year	11	13	19	13	20	31
Past month	4	6	8	5	12	18

Most recently available YRBS data (2017) suggests that more than a third (35%) of Delaware high school students have used "electronic vapor products" in their lifetime and roughly 13% have used them at least once in the past 30 days. Although the reported YRBS lifetime rate did not change significantly from 2015 to 2017, the reported past month rate represents a decrease in use (from 24% to 13%). Among high school students who report using a vaping device in the past 30 days, 16% report that they bought them at a store, 37% report that they borrowed or bummed them from someone else, and 12% report that a person 18 or older bought the device for them.

Findings from the 2018 YTS reveal that one in three students (grades 6th through 12th) have ever used an e-cigarette or vaped and 17% have vaped within the past month. YTS data also indicate that a substantial percentage of students have close friends who vape; of those surveyed, 16% of middle school students and 33% of high school students report that at least one of their four closest friends used a vaping product. There is also a substantial and statistically significant positive correlation between self-reported past month vaping among students and the number of close friends they have who vape. When asked how many of their four closest friends vape, JUUL, or use e-cigarettes, only 3% of students who report *none* of their close friends vape report vaping themselves in the previous month. As students report that more of their closest friends vape the likelihood of their own vaping rises steadily. Among students who said *one* of their close friends vape, 20% report vaping in the past 30 days; among students who said *four* of their close friends vape, the rate of their own vaping in the past 30 days increases to 79%.

Survey responses from the 2018 YTS among high school students suggest that most students begin vaping in high school. While 4% of students report that they first tried vaping at the age of 13, that percentage doubles to 8% of students who report that they first tried vaping at the age of 14. Additionally, 7% of students report they vaped for the first time at age 15, 6% at age 16, and

DOI: 10.32481/djph.2020.08.019

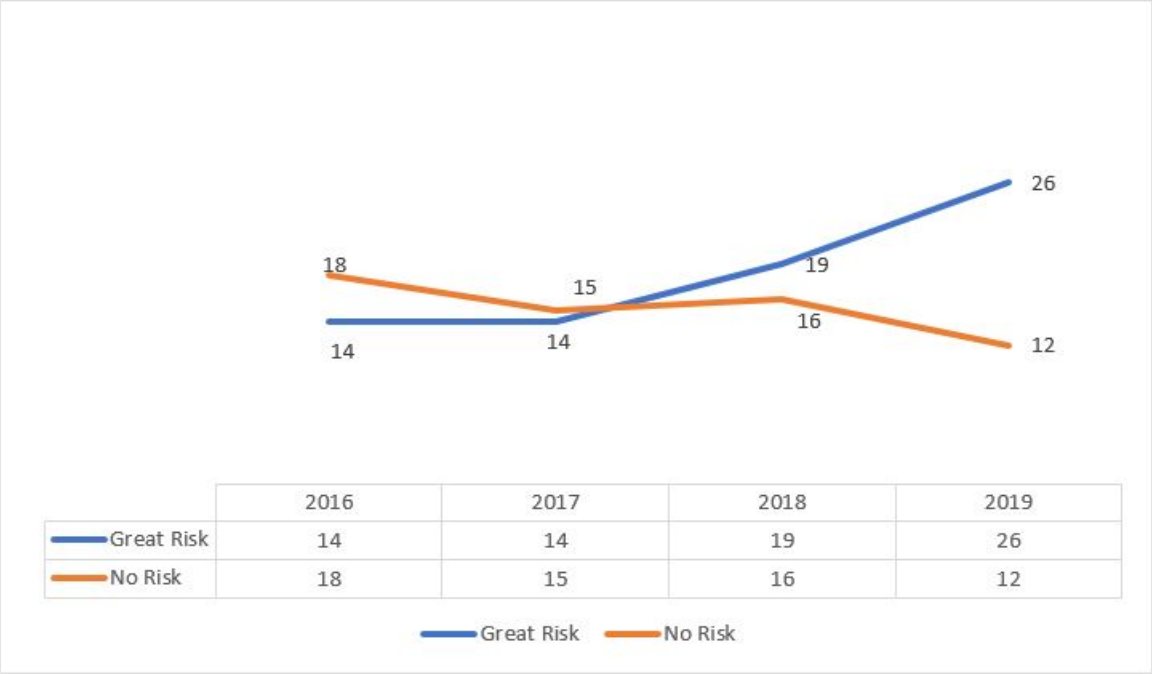
4% at age 17. When compared to YRBS high school data, the age of initiation for vaping is not markedly younger or different from other popular substances such as alcohol or marijuana.

The 2019 DSS also includes a question about *what* students are vaping. Among 11th graders who responded, 21% of students say they used flavored e-liquids, 19% used marijuana, 16% used nicotine, 5% synthetic marijuana, and 4% other drugs. (This is a mark-all-that-apply question and there is substantial overlap among these categories.)

Perception of Risk Associated with Vaping

The DSS has included a question about students' perception of risk from vaping since 2016. The percentage of students who believe vaping presents a great risk is clearly increasing, while the percentage of students who think there is no risk is decreasing more slowly (see Figure 2). Notably, the first two years that this question was included on the survey the perception of "no risk" among 11th grade students is actually greater than the perception of "great risk" from using vaping products.

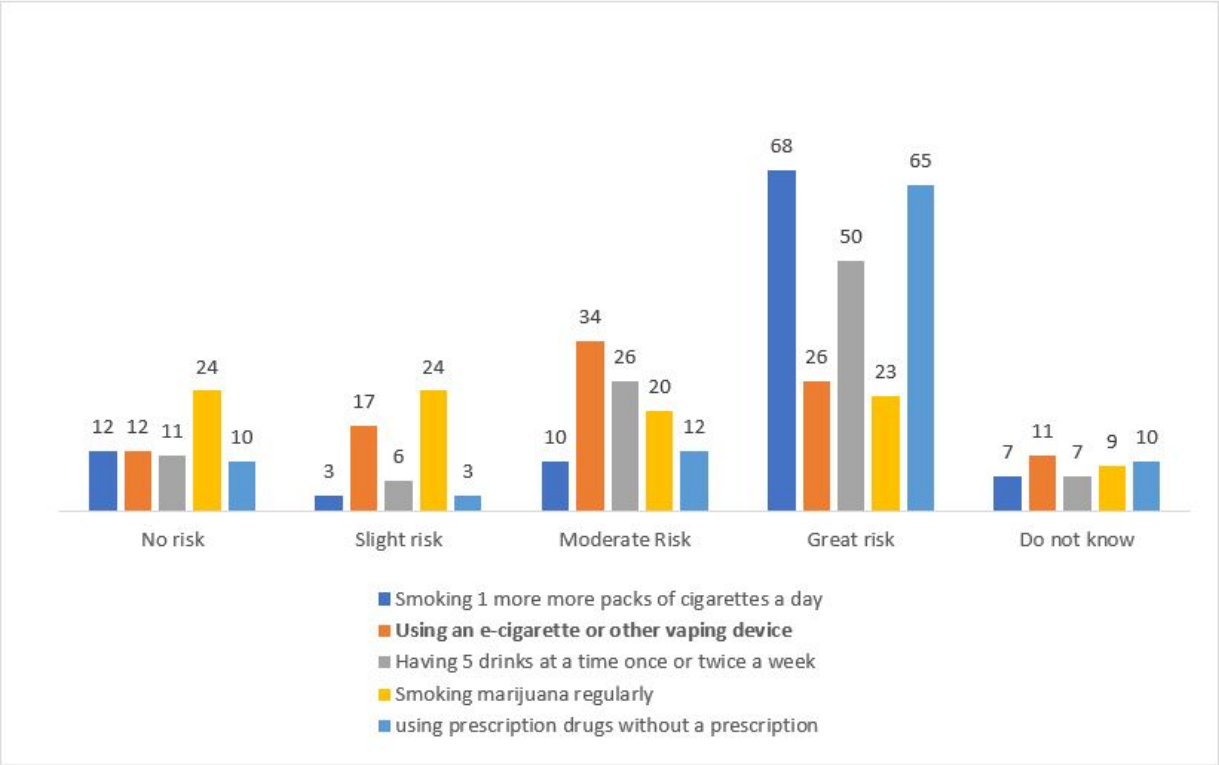
Figure 2. Trends in perceptions of risk from vaping (%). Delaware School Survey (DSS, 2016-2019).



When compared to student perceptions of risk associated with other drug and alcohol use, it becomes clear that students still do not believe that vaping is as risky a behavior as most other drug use, with the exception of marijuana use. Approximately a quarter of surveyed 11th grade students report that using an e-cigarette or vaping device presented a great risk of harm, while two-thirds of surveyed students believe that smoking a pack of cigarettes presented a great risk (see Figure 3). Students most commonly report a perceived moderate risk from vaping.

Figure 3. Perceptions of risk by substance use among 11th graders (%), 2019 Delaware School Survey (DSS).

DOI: 10.32481/djph.2020.08.019



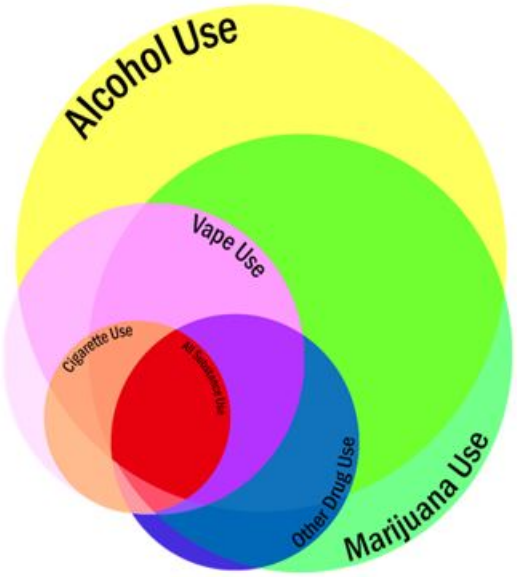
Co-occurrence of Vaping with Other Substance Use (Polysubstance Use)

The Polysubstance Venn Diagram (Figure 4) depicts the intersection of multiple substance use among 11th graders. In 2018, more than half (55%) of 11th grade Delaware students responding to the DSS report using some substance in the past year while 45% of students report no past year substance use. Seventeen percent of all 11th graders surveyed report having vaped in the past year. Thirteen percent of 11th graders report both vaping and marijuana use, 15% report vaping and alcohol use, and 12% report vaping and the use of both alcohol and marijuana. Two percent of students report using all of the substances named (alcohol, marijuana, cigarettes, and e-cigarettes), as well as at least one of the substances categorized together as "other drugs" (defined as at least one of the following in the past year: ecstasy, hallucinogens, downers, prescription uppers, street uppers, painkillers, Ritalin, crack, cocaine, heroin, or synthetic marijuana).

Of note, in the 2018 DSS sample, all students who report smoking cigarettes in the past year (6.5%) also report vaping during that period.

Figure 4. Past Year Polysubstance Venn Diagram, 2018 Delaware School Survey, Center for Drug and Health Studies, University of Delaware

DOI: 10.32481/djph.2020.08.019



Relationship between Vaping and Other Risk and Protective Factors (including ACEs)

Prior research indicates that other substance use rates are higher among students who report having experienced one or more *adverse childhood experience* (ACE).[13] YRBS data was analyzed to consider the relationship between vaping and ACEs. The prevalence of past month vaping among high school students increases with the number of ACEs. Seven percent of students who report no ACEs report vaping in the past month, compared to 17% of students with one ACE who vape, and nearly a quarter (24%) of students with two or more ACEs who vape. This disparity is replicated with several individual indicators as well, such as bullying, parental incarceration, and housing instability.

Prior research also indicates that students with a disability are more likely to misuse substances.[14] Analysis of 2017 YRBS data substantiates this as students who report having a disability are more likely to report past month rates of vaping than students who do not report having a disability (18% compared to 12%).

On a positive note, several protective factors appear associated with reduced rates of vaping. Approximately one in ten students who report that their parents are “always” proud of them, take an interest in them, listen to them, and can be counted on report vaping within the past month; one in four students who report “never” to the same questions report vaping within the past month.

Discussion

One of the most noteworthy and alarming characteristics of vaping is the high prevalence and the quickness with which it became so popular among teens. Because these devices are relatively new compared to other substances being used by students, longitudinal data about vaping is not

DOI: 10.32481/djph.2020.08.019

yet available. Few data sources, if any, have been tracking the use of vaping devices by students for longer than the past five years. Due to the rapidly evolving nature of vaping devices, survey questions have changed over the years to include more categories of vaping devices; even so, it is possible that survey results still undercount the true prevalence of vaping among youth. It is equally concerning that although an increasing percentage of DSS respondents report a perception of "great risk" from vaping, the prevalence of vaping among students continues to rise. This may be due in part to the "vape culture" that has emerged, which views vaping not as a health behavior but a lifestyle – a perception that has flourished particularly among youth. In a recent social media analysis, researchers found that 45% of individual followers of JUUL were between the ages of 13 and 17.[15] YTS data also illustrates that peer activity is associated with a student's likelihood of vaping; while only 3% of students vape among those who do not have a close friend who vapes, four out of five students vape when they have four close friends who do.

It is striking that every student who reports smoking cigarettes, 6.5% of 11th graders, also reports the use of an e-cigarette or vaping device in the 2018 DSS. This does not indicate that all individuals who smoke cigarettes also vape – the degree to which use of cigarettes and vaping devices overlap varies based on the wording of a question asked in a specific survey, the population being surveyed, the timing and frequency of survey administration, and other contextual factors. However, it does suggest that there is a high degree of overlap between cigarette smoking and vaping, which is supported by similar findings in the 2017 11th grade DSS (60% of those who report smoking cigarettes in the past year also report vaping in the past year), the 2019 11th grade DSS (88% of those who report smoking cigarettes in the past year also report vaping in the past year) and the 2017 YRBS (of those who report smoking cigarettes in the past month, 60% report vaping in the past month). This consistently high degree of overlap could be a result of students moving from smoking to vaping, with many of those who continue to smoke cigarettes vaping as well. This is especially troubling given that vaping has been marketed as a strategy to quit smoking traditional cigarettes.

Another notable finding is that the rate of past month vaping decreases when comparing the 2015 and 2017 YRBS reports. This is consistent with data from the national YRBS sample during the same time frame and reflected a similar dip in self-reported vaping on the DSS from 2016 to 2017. However, this is counter to the overall DSS trend which shows increases from 4% in 2011 to 18% in 2019. It will be important to review the trend line once the 2019 Delaware YRBS data has been analyzed and released by the CDC. It should be recognized that JUUL entered the market during this period and its use skyrocketed quickly. Anecdotally, we know that many young people did not perceive JUUL to be the same as other e-cigarettes, and survey questions were not amended to specifically ask about JUUL until 2018 (DSS) and 2019 (YRBS). It is possible that this anomaly does not represent an actual decrease in vaping but a gap in the survey questions themselves.

Epidemiologists as well as policy makers, practitioners, and prevention specialists are interested in understanding which populations experience disproportionate risk for certain health conditions and behaviors. While there is a high prevalence of vaping among students across all demographic backgrounds and social experiences, the analysis of Delaware data indicates that some student populations are at increased risk for vaping, just as they are for other substance use. YRBS analysis suggests a positive association between students who report ACEs and vaping (students who confirmed experiencing any of the following events: homelessness, incarcerated parent, fighting, being threatened, being bullied, or teen dating violence or sexual violence, were

placed in either "1 ACE" or "2 or More ACEs" category depending on the number of different experiences they reported). From this data analysis, we cannot determine if one condition causes the other, or if they are both caused by other factors. But it is an important observation given that we know people who experience one or more ACE are more likely to experience greater risk for health and other challenges throughout their lives. (The association between Delaware youth substance use and ACEs has been discussed more broadly in the SEOW's annual Delaware epidemiological report.)[16]

There is also a positive association among vaping and students who report that they have at least one disability. According to the 2019 Delaware State Epidemiological Profile, students who report having a disability are also more likely to report using cigarettes, alcohol, marijuana, and to binge drink than other students.[16]

As we consider the elevated risk for vaping among certain groups of students, it is important to recognize the key takeaway illustrated by the polysubstance Venn diagram: students who use one substance have a greater risk of using other substances. Not only are students who vape more likely to smoke cigarettes, they are more likely to use alcohol or other drugs, which come with other associated risks. We need to emphasize that the strong correlation between vaping and other substance use does not necessarily indicate a causal relationship between vaping and other health risk behaviors, but this data underscores the need to recognize and leverage shared opportunities for prevention and intervention.

Finally, the analysis highlights a number of protective factors related to parental engagement that are associated with reduced risk for vaping, which is consistent with the literature for reduced risk of other substance use and mental health problems.[17]

Limitations

There are several limitations to this analysis. Each survey was administered to students in public school settings. It would be valuable to survey students in private school and other settings if the resources to do so were to become available.

School participation rates have been declining in Delaware for the three surveys analyzed. Based on communications with other national and state survey administrators, this is not unique to Delaware. CDHS has been collaborating with State funding agencies, educators, and other advocates to: identify and reduce barriers to participation; ensure that data collected is available to support the needs of educators and students; and promote the availability of data for their use. These data support needs assessments, grant applications, program development, strategic planning, and evaluation of sponsored projects. Although the sample sizes reviewed here provide meaningful analysis, if this trend continues, the capacity for future analysis may be jeopardized.

There are noted differences among the vaping rates across the three surveys. This may be due to the wording and order of specific questions on a given instrument, the timing of survey administration, participation rates, and differences among samples. Generally, however, the findings reflect overall consistency across instruments as well as with national data sources and when compared to the literature. Longer trend lines and other types of data (for example, focus group data, observational school data, etc.) will help to provide insights into behavior.

A challenge with any school-based survey is that it only captures data from students who attend school on a given day. Students who are most likely to experience adversities or engage in risky

DOI: 10.32481/djph.2020.08.019

behavior are also students at greater risk to miss school. Therefore, the reported rates of any risk behavior may be lower than actual prevalence rates.

A number of associations have been noted: students who report experiencing ACEs are more likely to report vaping compared to students who do not report ACEs; students who report having a disability are more likely to report vaping compared to students who report no disability; students who report experiencing high rates of parental engagement report lower rates of vaping than students who do not report similar levels of support. However, on the basis of our analyses, we cannot draw conclusions about the nature of these associations, only that they co-occur and that they merit further examination.

Delaware's Response to the Surge in Vaping: Policy and Legislation, Promising Practices, and Recommendations

There are multiple contributing factors to the popularity of vaping among Delaware youth. Just as comprehensive approaches using best practices have reduced traditional cigarette use in Delaware, a comprehensive, coordinated approach from various sectors and disciplines is required to address the surge in vaping. In this section, we highlight key collaborative initiatives implemented by Delaware lawmakers, public health officials, tobacco and other substance prevention and control advocates, and educators.

Legislative Responses

Since 2014, several legal remedies have been enacted or amended to help reduce the use of e-cigarettes and related products among Delaware youth. An amendment to the youth access law, which prohibits the sale of tobacco and tobacco products to minors, was expanded to include tobacco substitutes (such as e-cigarettes) on July 1, 2014. Comprehensive policy analysis (for example, that presented in the Public Health Implications of Raising the Minimum Age of Legal Access to Tobacco Products) posits that raising the minimum legal age of purchase would likely delay smoking initiation, with the possible public health benefits of reducing overall prevalence and premature death.[18] In 2019, Delaware became the 12th state to raise the age of sale for tobacco products to 21 years. It is worth noting that the Delaware bill included language that defined "tobacco substitutes" as being those *with* and *without* nicotine, reflecting the pervasive use of flavored vape juice and its appeal to teens.

As a means of protecting the general public from the effects of secondhand smoke related to vaping, the Clean Indoor Air Act was amended in October 2015 to prohibit the use of electronic smoking devices anywhere that traditional tobacco products could not be used. This includes the prohibition of vaping in common use areas, hospitals, schools, gyms, daycare facilities, restaurants, workplaces, and many other publicly shared spaces.

Research indicates that the implementation of excise taxes on traditional cigarettes have been positively associated with some reduction in smoking, especially among younger adults.[19] In July 2017, Governor Carney signed Delaware House Bill 242 which added definitions of vaping products, required licensure for the sale of vaping products (similar to that of traditional tobacco vendors), and imposed a tax of five cents per fluid milliliter.

DOI: 10.32481/djph.2020.08.019

Collaborative Public Health, Prevention, and Education Evidence-based Approaches

State agencies, community organizations, and educators are collaborating to raise awareness of vaping among youth and their families. Delaware partners are adopting innovative approaches steeped in evidence. Evidence-based programs, practices, and policies are interventions that have gone through a process of scientific review and the implementation of these interventions (with fidelity) is critical to data-driven decision making. A search of the Results First Clearinghouse Database found several tobacco cessation and prevention strategies that have been designated as "highest rated" – media campaigns, taxes, prevention education, and quitlines among them. When it comes to the use of vaping and traditional tobacco products, evidence-based programs target two points on the continuum – cessation and prevention.

Public Health Campaigns

Vape products continue to evolve to be sleeker, more discrete, and more appealing and addicting with unique flavorings and high amounts of nicotine as youth use has skyrocketed. In 2016, the Division of Public Health (DPH) conducted a mass reach media campaign (Don't Be an E-cig Guinea Pig) to dissuade youth from using e-cigarettes. More recently, based on feedback from youth focus group participants, DPH has developed new media campaigns for youth to raise awareness that vape products contain as much if not more nicotine than a pack of cigarettes. In addition, the age requirement of the Delaware Quitline has been lowered to 13 years to provide more available cessation resources to youth facing nicotine addiction. The DPH Tobacco Prevention and Control Program (TPCP) has been investing considerable time at Delaware schools in each County to provide education on vaping, especially after the EVALI outbreak.

Educators as Partners: Behavioral Health Multi-Tier Systems of Support in School Settings

Vaping is one of a number of youth behavioral health issues that stakeholders throughout Delaware have been working to address. In recent years, advocates across disciplines and sectors have focused on strategies to identify and foster shared protective factors and reduce shared risk factors common to multiple public health concerns. Increased awareness of the negative health impacts of ACEs and trauma has led to initiatives designed to foster resiliency and promote trauma-informed environments in schools and other settings. As part of that process, in 2019, Delaware's Department of Health and Social Services (DHSS), the Delaware Department of Education (DOE), and Department of Children, Youth, and their Families (DSCYF) embarked on an interagency partnership to conduct school district level needs assessment. DHSS Divisions of Substance Abuse and Mental Health (DSAMH) and Public Health collaborated with DOE and DSCYF's Division of Prevention and Behavioral Health Services (DPBHS) to create, field, and analyze district level assessments of available resources and existing gaps. The assessments focused on each district's capacity for and availability of policies, programs, practices (including curriculum), and personnel for a range of topics linked to promoting health, preventing and responding to health concerns, and addressing service needs of students. Topics included behavioral health (both substance use prevention and mental health), physical activity, nutrition, vision, oral health, and asthma. Of the 19 school districts in Delaware, 15 participated in the assessment process in addition to two large charter school networks with student populations over 1,200.

DOI: 10.32481/djph.2020.08.019

Needs assessments findings show that although districts are addressing health and wellbeing, clear opportunities exist to improve these efforts, including the need to strengthen student supports and professional development relating to substance use. Though the State's health education regulations set a minimum number of hours dedicated to drug and alcohol education,[20] school districts and schools select and implement evidence-based curriculum aligned with their unique needs and student populations. Yet even with this strong State regulation for comprehensive, evidence-based health education, only half of participating districts report providing health education for all student populations. Based on the findings and the final report and recommendations[21] from the Delaware Youth Drug Prevention Curriculum Task Force (created by Senate Concurrent Resolution 69), DSAMH, DOE, DPBHS, and DPH provided support in the process to align and harmonize curriculum, policy, and practices to improve student health and wellbeing and respond to new and emerging challenges such as vaping. District and State agency representatives met during the summer of 2019 to create plans to address needs related to substance use prevention and behavioral health concerns. To align efforts, DSAMH and their partners created a "driver diagram," a range of evidence-based interventions to address universal, primary prevention approaches, selected interventions to help a smaller number of students in danger of engaging in risky behavior, and indicated interventions and services for students in need of more structured and intensive support. The Behavioral Health Multi-Tier System of Support (BH-MTSS) was designed to help schools implement behavioral health approaches that complement and align with their academic Multi-Tiered System of Supports which guide policies, practices, and personnel related to educational and academic achievement.

Leveraging several grant funding streams, in 2019-2020 DSAMH provided funds to districts participating in this process to implement prevention-related action plans, in coordination at high schools with the State's School-Based Wellness Centers. Using the BH-MTSS, several districts identified the sudden and rapid rise of vaping among their students as a particular concern and identified strategies that align with Tier 1 interventions – creating supportive school, peer, and community environments through changing policies and practices to optimally support youth, and a focus on identifying alternative discipline pathways for youth caught vaping at school. Since then, districts and high schools have begun working with their School-Based Wellness Centers and qualified mental health professional staff to screen, refer, and provide behavioral health – both mental health and substance use – treatment and recovery services.

At the Tier 1 level, several districts and high schools are addressing vaping by examining their current health education offerings to ensure that prevention sufficiently addresses this concern and provides evidence-based content aligned with state health education standards, and with similar and complementary approaches to preventing youth substance use. At least four districts and high schools, in partnership with their School-Based Wellness Centers, will review their current policies related to vaping and shift to alternatives that promote health, build protective factors, and increase students' understanding of the effects of vaping. These districts will also use vape detectors as part of their approach to identify students vaping at school.

As part of their Tier 2 approaches, these districts will screen to differentiate students potentially in need of intervention services, such as cessation or addiction services for vaping, from those who would benefit from prevention strategies, such as students curious about or experimenting with vaping.

DOI: 10.32481/djph.2020.08.019

Case Study: Creating and Testing a Supportive Model for Vaping Detection and Response

Through the needs assessment, POLYTECH School District in Woodside, Delaware identified vaping as its primary area of focus. Members of the school's leadership, health staff, and wellness center had been seeking innovative approaches to address this pressing issue. Concurrently, the Division of Public Health TPCP had begun the development of a toolkit to serve as a one stop vaping resource for educators, parents, students, and health care providers. In November 2019, the POLYTECH District Wellness Committee and DPH coordinated efforts to develop an online vaping toolkit (VapeFreeDE.org). DOE, DSCYF, the Division of Alcohol and Tobacco Enforcement, and the American Lung Association also participated in its development which was supported in part with funds from the Delaware Cancer Consortium. The toolkit integrates credible and evidence-based resources from the CDC, Food and Drug Administration, the Surgeon General and Public Health Law Center, with meaningful input from students and families. Once developed, POLYTECH agreed to beta-test the toolkit, which they found to be helpful and key to their response to vaping. Recently launched on the Healthy Delaware website, the toolkit has several user-friendly components which include resources for educators such as curriculum, model policies, fact sheets, and presentations; cessation resources; and information for specific audiences (parents, teens, educators, health care providers, etc.). Hard copies of fact sheets, posters, and mirror clings are also available upon request.

A unique feature of the toolkit, the social media calendar contains pre-written messages about vaping that can be shared with students and parents throughout the school year. POLYTECH High School was instrumental in shaping the development of the calendar to facilitate consistent and conversations with students and parents about this growing public health challenge. To promote ongoing assessment and updated messaging, the toolkit includes a prominent "Feedback" button that remains visible when exploring all features.

Polytech's vaping initiative is district-wide and is being coordinated by the District Wellness Committee, which is comprised of district office, high school, Wellness Center, and adult education staff members. Although the work began in the high school, portions are being implemented in the adult education division.

Moving Forward: Changing School Policy and Practice to Address Vaping

High schools and districts that identified vaping as a priority in their BH-MTSS work will use the online toolkit to conduct customized prevention efforts. Each of the schools and districts, in collaboration with School-Based Wellness Centers, will integrate approaches to provide education and cessation to students and refocus discipline policies from punitive to rehabilitative approaches. For example, students caught vaping will immediately view the Know the Risks presentation[22] developed by the CDC and adapted with a voiceover component by DOE.

For students who need an approach that integrates cessation, schools will also use the American Lung Association's Intervention for Nicotine Dependence: Education, Prevention, Tobacco and Health (INDEPTH), a program which offers an alternative mechanism to in-school suspensions or citations resulting from vaping at school.[23] In lieu of punitive disciplinary measures, students will use time during the school day, such as enrichment periods, or after school to participate in INDEPTH's four, 50-minute comprehensive educational modules on a variety of tobacco-related issues. INDEPTH modules can be accessed in a group or individual setting. Results of a pilot

DOI: 10.32481/djph.2020.08.019

evaluation of the INDEPTH program found that 60% of students surveyed were willing to try quitting the use of nicotine, vaping, or tobacco products after their participation.[23]

Although implementation of new policies was scheduled to start in Spring 2020, because of the COVID-19 pandemic and the transition to distance learning for Delaware students, plans have been temporarily suspended but will be reevaluated when schools reopen.

Recommendations

Despite the magnitude of the issue, State agencies, schools, community organizations, and other stakeholders have collaborated to implement a number of strategies to reduce teen vaping. It is critical to recognize the need for ongoing data collection through instruments such as the Delaware School Survey, the Youth Risk Behavior Survey, and the Youth Tobacco Survey. The data produced will allow public health advocates to continue to monitor rates of vaping and associated health risks that youth experience and support data-driven prevention programs, policies, and evaluation. There are a number of other recommendations to consider as advocates move forward.

It is important to take stock and build upon ongoing resources, assets, and activities that are currently in place and working well to promote health and discourage risk. The data presented in this paper illustrate that vaping is associated with other substance use risk behaviors. Additional data has been referenced that illustrate the links between substance use and mental health risks. There are multiple prevention initiatives throughout the state designed to address one or more risks commonly experienced by adolescents and young adults. Coordinating and leveraging these efforts will create a more cohesive approach to preventing multiple issues. Comprehensive, evidence-based health curricula will help to facilitate this coordinated effort. Continued collaboration across sectors and disciplines is key.

Approaches that emphasize asset building and protective factors will help youth to build the resilience and skills required to navigate a variety of risk behaviors and challenges they will encounter throughout their lives. Trauma informed school environments and behavioral health multitiered systems of care, already underway in some areas, will allow schools and districts to implement policies that promote health and allow students to practice healthy habits and achieve success. As part of this, shifting away from punitive responses to issues such as vaping will allow schools to redirect problem behaviors so that they become opportunities to develop knowledge and pro-social skills.

To facilitate change, it will be critical to ensure that everyone involved has a voice in the process. Youth should be engaged to meaningfully contribute to or even lead any efforts to promote health, as POLYTECH did with the vaping toolkit and corresponding social media calendar. Parents, educators, and others should share in the process as well.

Finally, in early 2020, the Delaware Attorney General announced that the state was participating in a multistate coalition to investigate JUUL Labs' marketing and sales practices which have targeted youth.[24] Participating in regional and national efforts to address broader influences that impact vaping behaviors and attitudes will supplement and strengthen the multidisciplinary efforts undertaken by local advocates.

DOI: 10.32481/djph.2020.08.019

Conclusion

As the data shows, youth vaping is a significant public health challenge in Delaware and comprehensive measures to educate students and families are required to address it. Advocates across sectors have formed partnerships that provide a foundation for developing evidence-based responses and have initiated several promising programs, including the Vape Free DE online toolkit. Successful efforts should incorporate the voices of teens and their families to inform prevention strategies. Ongoing surveillance is vital to monitor the rate of vaping and other conditions associated with this behavior.

Acknowledgements

The authors greatly appreciate the information and assistance provided by the following individuals as we developed this paper: Amelia Hodges (superintendent), Vienna Walker, and Nicholas Johnson (POLYTECH School District); Christine Alois (deputy secretary), Susan Haberstroh, and Sabra Collins (Delaware Department of Education); Fred Gatto and Elizabeth Dubravcic (Division of Public Health, Delaware Department of Health and Social Services); Elizabeth Romero (director, Division of Substance Abuse and Mental Health, Delaware Department of Health and Social Services); Rochelle Lazorchak and Yvonne Bunch (Division of Prevention and Behavioral Health, Delaware Department of Services for Children, Youth and their Families); Laura Rapp (Center for Drug and Health Studies, University of Delaware). We would also like to thank Jim Highberger and Rochelle Brittingham at the Center for Drug and Health Studies who lead the youth surveys explored in this paper. For more information or to review the survey instruments, visit: https://www.cdhs.udel.edu/projects/delaware-focus/delaware-youth-and-young-adults.

References

1. National Institute on Drug Abuse. (2019). Monitoring the future 2019 survey results: vaping. Retrieved from: https://www.drugabuse.gov/related-topics/trends-statistics/infographics/monitoring-future-2019-survey-results-vaping
2. Food and Drug Administration and the Centers for Diseases Control and Prevention. (2019). Youth tobacco use: results from the national youth tobacco survey. Retrieved from: https://www.fda.gov/tobacco-products/youth-and-tobacco/youth-tobacco-use-results-national-youth-tobacco-survey
3. Centers for Disease Control and Prevention. (2020). Quick facts on the risks of e-cigarettes for kids, teens, and young adults. Retrieved from: https://www.cdc.gov/tobacco/basic_information/e-cigarettes/Quick-Facts-on-the-Risks-of-E-cigarettes-for-Kids-Teens-and-Young-Adults.html#one
4. Food and Drug Administration. (2016). The “deeming rule”: vape shops. Retrieved from: https://www.fda.gov/media/97760/download
5. Reisinger, D. (2018, Oct.). JUUL reached its $10 billion valuation 4 times faster than Facebook. Fortune. Retrieved from: https://fortune.com/2018/10/10/juul-vaping-pen-valuation-vs-facebook/
6. U.S. Department of Health and Human Services. (2016). 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. Retrieved from: https://www.cdc.gov/tobacco/data_statistics/sgr/e-cigarettes/pdfs/2016_sgr_entire_report_508.pdf

7. Jackler, R. J., Chau, C., Getachew, B. D., Whitcomb, M. M., Lee-Heidenreich, J., Bhatt, A. M., . . . Ramamurth, D. (2019). JUUL advertising over its first three years on the market. Stanford Research into the Impact of Tobacco Advertising, Stanford School of Medicine. Retrieved from: http://tobacco.stanford.edu/tobacco_main/publications/JUUL_Marketing_Stanford.pdf
8. Jackler, R. J., Ramamurthi, D., & Louis-Ferdinand, N. H. (2019). Rapid growth of JUUL hashtags after the company ceased promotion. *Stanford Research into the Impact of Tobacco Advertising, Stanford School of Medicine*. Retrieved from: http://tobacco.stanford.edu/tobacco_main/publications/Hashtag_JUUL_Project_7-22-19F.pdf
9. Rossheim, M. E., Livingston, M. D., Soule, E. K., Zeraye, H. A., & Thombs, D. L. (2019, July). Electronic cigarette explosion and burn injuries, US Emergency Departments 2015-2017. *Tobacco Control*, *28*(4), 472–474. PubMed https://doi.org/10.1136/tobaccocontrol-2018-054518
10. Centers for Disease Control and Prevention. (2020). Outbreak of lung injury associated with the use of e-cigarette, or vaping, products. Retrieved from: https://www.cdc.gov/tobacco/basic_information/e-cigarettes/severe-lung-disease.html
11. Center for Drug and Health Studies, University of Delaware. (2019). Polysubstance use among 11th graders. Retrieved from: https://www.cdhs.udel.edu/content-sub-site/Documents/Venn%20Diagram%20Polysubstance%20use%20among%2011th%20grade%20students.pdf
12. Centers for Disease Control and Prevention. (2018). Youth Risk Behavior Surveillance System (YRBSS). Retrieved from: https://www.cdc.gov/healthyyouth/data/yrbs/index.htm
13. Substance Abuse and Mental Health Services Administration Center for Application of Prevention Technologies. (2018). The role of adverse childhood experiences in substance misuse and related behavioral health problems. Retrieved from: https://mnprc.org/wp-content/uploads/2019/01/aces-behavioral-health-problems.pdf
14. Glazier, R. E., & Kling, R. N. (2013, April). Recent trends in substance abuse among persons with disabilities compared to that of persons without disabilities. *Disability and Health Journal*, *6*(2), 107–115. PubMed https://doi.org/10.1016/j.dhjo.2013.01.007
15. Kim, A. E., Chew, R., Wenger, M., Cress, M., Bukowski, T., Farrelly, M., & Hair, E. (2019, July 1). Estimated ages of JUUL Twitter followers. *JAMA Pediatrics*, *173*(7), 690–692. PubMed https://doi.org/10.1001/jamapediatrics.2019.0922
16. Center for Drug and Health Studies, University of Delaware. (2019). 2019 Delaware Epidemiological Profile. Retrieved from: https://www.cdhs.udel.edu/content-sub-site/Documents/EPI%20Report%202019%20-%20Rev%20-%20102919.pdf
17. Centers for Disease Control and Prevention. (2018). Adolescent school health. Protective factors. Retrieved from: https://www.cdc.gov/healthyyouth/protective/index.htm

18. Institute of Medicine. (2015). Public Health Implications of Raising the Minimum Age of Legal Access to Tobacco Products. Richard J. Bonnie, Kathleen Stratton, and Leslie Y. Kwan, Eds. Retrieved from: https://www.nap.edu/catalog/18997/public-health-implications-of-raising-the-minimum-age-of-legal-access-to-tobacco-products

19. Sharbaugh, M. S., Althouse, A. D., Thoma, F. W., Lee, J. S., Figueredo, V. M., & Mulukutla, S. R. (2018, September 20). Impact of cigarette taxes on smoking prevalence from 2001-2015: A report using the Behavioral and Risk Factor Surveillance Survey (BRFSS). *PLoS One*, *13*(9), e0204416. PubMed https://doi.org/10.1371/journal.pone.0204416

20. Delaware General Assembly. (n.d.). Delaware regulations: Administrative Code: Title 14: 800 851 K to 12 Comprehensive Health Education Program. Retrieved from: https://regulations.delaware.gov/AdminCode/title14/800/851.shtml

21. Delaware Youth Drug Prevention Curriculum Task Force. (2019). 2019 Senate Concurrent Resolution 69 - Delaware Youth Drug Prevention Curriculum Task Force Final Report. Retrieved from: https://delaware.contentdm.oclc.org/digital/collection/p16397coll14/id/177

22. Centers for Disease Control and Prevention. (2019). Know the risks: a youth guide to e-cigarettes. Retrieved from: https://www.cdc.gov/tobacco/basic_information/e-cigarettes/youth-guide-to-e-cigarettes-presentation.html

23. American Lung Association. (n.d.). INDEPTH: An alternative to suspension or citation. Retrieved from: https://www.lung.org/quit-smoking/helping-teens-quit/indepth

24. Department of Justice. (2020, Feb 25). Attorney General Jennings announces bi-partisan, multistate investigation of JUUL. Delaware NewsRetrieved from: https://news.delaware.gov/2020/02/25/attorney-general-jennings-announces-bipartisan-multistate-investigation-of-juul/