

MODIFICATION OF THE BUILT ENVIRONMENT TO REDUCE ADOLESCENT E-CIGARETTE
USE IN BURKE COUNTY, NC

Cokie Marie Dulnuan Caviness, Jessica Kalli Fortune-Ball, Ashley Pyo, Richaun Riddick

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fulfillment of the requirements for the degree of Master of Public Health in
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Approved by:

Margaret Eaglin

W. Oscar Fleming

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ABSTRACT

Cokie Marie Dulnuan Caviness, Jessica Kalli Fortune-Ball, Ashley Pyo, Richaun Riddick

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(Under the direction of Margaret Eaglin, 1st Reader, & W. Oscar Fleming, 2nd Reader)

Adolescent e-cigarette use in Burke County, NC, emerges as a critical social determinant of health (SDOH), significantly impacting the well-being of individuals aged 10 to 19. The built environment directly influences e-cigarette accessibility and acceptability. Addressing this multifaceted health concern requires collaborative efforts to comprehend and tackle the underlying factors. The proximity of tobacco retailers to schools underscores the necessity for collective action to regulate tobacco sales near educational institutions. Moreover, prevailing perceptions among Burke County adolescents regarding vaping's safety and prevalence emphasize the pressing demand for intervention. By implementing targeted regulations and education campaigns to impact e-cigarette availability, Burke County can foster healthier environments for its adolescents, addressing the intricate dynamics influencing adolescent e-cigarette use and ultimately promoting community well-being.

Keywords: Adolescent E-cigarette Use, Tobacco, Vaping, Adolescent, Social Determinant of Health

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LIST OF ABBREVIATIONS

BCPS	Burke County Public Schools
BCHD	Burke County Health Department
CDC	Centers for Disease Control and Prevention
CDD	Community Development Department
NC	North Carolina
NCDHHS	North Carolina Department of Health and Human Services
SDOH	Social Determinant of Health

COMMON PROPOSAL

Social Determinant of Health (SDOH) Analysis

E-cigarette use among adolescents in Burke County has become a rising concern, prompting the school board to implement an anti-vaping policy in 2023 (Burke County Public Schools [BCPS], 2023). E-cigarettes, also known as vapes, are tobacco products that contain nicotine (CDC, 2023). As schools are a common site where adolescents vape (Dai, 2021), creating a healthy school environment for students is paramount in tackling this social determinant of health (SDOH). Highlighting the built environment surrounding schools also brings attention to the close proximity between tobacco retailers and schools in the county; for example, there are three tobacco shops within half a mile of Burke Middle College, one of the public high schools in the area (Google, n.d.) (see Appendix A.3). Across the county, there are five middle schools and four high schools within BCPS, with sixteen smoke shops less than three miles from a school (Google, n.d.); proximity to tobacco retailers has been associated with increased smoking prevalence, underscoring the importance of this SDOH (Henriksen, et al. 2008). BCPS has also cited the marketing of fruity flavors of vape cartridges towards young people as a contributing variable to this increase (BCPS, 2023).

The prevalence of adolescent smoking in Burke County is 23%, higher than the NC state prevalence of 17% (Burke County Health Department [BCHD], 2022). Within Burke County, over 40% of high schoolers do not believe vaping is dangerous (Burke County, 2022). In addition, Burke County high schoolers believe that the number of students being caught vaping is much lower than the actual prevalence (The Morganton News Herald, 2023), and many believe that vaping “is normal” (The Morganton News Herald, 2023).

These perceptions can be harmful, especially since the use of e-cigarettes can adversely affect adolescents’ immediate and long-term health (Hamberger and Halpern-Felsher, 2020). The nicotine in vapes is highly addictive and damages adolescents’ developing brains (CDC, 2022), leading to impaired cognitive function, increased risk for mood disorders, and increased predisposition for substance use abuse (Farber, Pakhale, and Neptune, 2016). E-cigarette inhalation causes immediate respiratory distress

and cardiovascular effects, and long-term exposure can cause irreversible lung damage (Gordon et al., 2022).

This urgent health concern underscores the critical role of the built environment in shaping community health outcomes, necessitating collaborative efforts to address this SDOH. Zoning is a critical component of the built environment, for both current and future community planning to regulate the density of tobacco retailers near schools through effective collaboration to design comprehensive intervention strategies (The Community Tool Box, 2023; BCPS, 2023). Overall, reducing the usage of e-cigarettes presents a multifaceted challenge tied to their widespread availability and easy accessibility at gas stations, convenience stores, local grocery stores in addition to tobacco shops.

Contextual Analysis

Tackling this SDOH will require the inclusion of various stakeholders from the community. Important community partners described in the stakeholder analysis grid (see Table A.3) include adolescents, parents, school officials, healthcare professionals, and zoning officials. Local business owners who sell tobacco products may be consulted for their input, but they may not necessarily hold a position in a task force. Working with such a diverse group of community partners will warrant respect and communication in order to foster a welcoming environment for collaboration. Commissioners must confront power dynamics and practice engagement strategies that value all stakeholders in creative ways.

To address the built environment and neighborhood conditions that make it more or less likely for youth to engage in tobacco use, a collaboration of various stakeholders will be convened to drive this change effort who will serve as project champions in their respective spheres of influence. This includes BCPS, parents, a zoning officer from the County Planning Department, Burke Recovery's Adolescent Preventive Services, and BCHD. Burke students will be represented, as student voice will be key to identifying methods and programming that resonates with youth, as well as illuminating relevant challenges with respect to tobacco and vaping use pressure (Miller et al., 2023). The project will be guided by the shared vision that Burke County youth enjoy tobacco- and vape-free lives, enabled by an environment that promotes their health and wellbeing.

To gain a deeper understanding of e-cigarette use among adolescents in Burke County, it's essential to view the problem through the lens of quality improvement. The built environment encompassing e-cigarette use in Burke County, NC offers easy access, multiple retail locations, and local youth-targeted marketing campaigns which makes it challenging to address the continuous rise in e-cigarette use among the adolescent population. With Burke County, NC having a higher adolescent smoking population than the U.S., working with the Burke County Health Department to create education and smoking cessation programs would not only assist the Burke County Health Department in meeting its accreditation needs but also provide the steering committee and community partners with more access to resources. Together with the Burke County Health Department, the aim would be to reduce e-cigarette use among adolescents in Burke County, NC. This would be accomplished by the conclusion of the 2024-2025 school year by streamlining smoking cessation initiatives. This involves developing, implementing, and evaluating a health promotion campaign for the schools and their surrounding communities, fostering a healthier neighborhood, and built environment. This is important because Burke County Public Schools are experiencing a rise in school suspensions due to e-cigarette usage and the Burke County Health Department needing to meet accreditation requirements.

E-cigarette use among adolescents in Burke County presents a complex challenge influenced by various factors. The built environment, including retail locations, significantly contributes to adolescents' access to e-cigarettes. However, solutions to this issue, such as zoning restrictions or marketing regulations, are intricate and may inadvertently worsen the problem. This underscores the need for careful consideration of unintended consequences. Addressing the availability of e-cigarettes and implementing comprehensive educational programs on their health consequences are crucial steps. By enforcing stricter regulations and investing in awareness initiatives, stakeholders can disrupt reinforcing loops associated with easy access to these products, aiming for sustainable solutions.

Recommendations for Action

Zoning officials from the Community Development Department (CDD) play a crucial role in shaping the built environment, impacting community health outcomes, particularly concerning adolescent

e-cigarette use. Despite their influence, barriers to engagement exist, including limited awareness of the health implications of tobacco retailer proximity to schools, competing priorities within the CDD, and resistance from stakeholders opposed to zoning restrictions. Overcoming these barriers requires providing evidence-based data and offering flexible engagement opportunities. Proposed methods include stakeholder workshops, policy briefings, and community forums to raise awareness, address competing priorities, and foster shared decision-making. These efforts aim to ensure active participation from zoning officials in collaborative endeavors addressing the social determinant of health related to adolescent e-cigarette use in Burke County.

To tackle conflict resolution and sustain momentum, the steering committee will create and adhere to a collective agreement outlining the group's operational guidelines and utilize a RASCI analysis, a tool that increases accountability for each project (see Table A.2). This agreement will support the data collection of the three primary benchmarks which are member engagement and satisfaction, community partner initiatives, and progress in planning and implementation. Throughout this project, the goal is to reach a shared consensus on all aspects. Given the power differentials that will be present in the committee, creating a safe space where all participants feel valued is critical (Yukl, 2013).

To address unmet activity 10.2 (partner with local organizations to create educational materials) identified by the North Carolina Local Health Department Accreditation Board, the Burke County Health Department must engage in continuous quality improvement (CQI) methods. Specifically, the department should develop a change idea to test, such as the creation of a training manual for school officials that educates them on e-cigarette use and strategies to promote a tobacco-free environment for students. The Model for Improvement (MFI) is a powerful tool that would test this change idea (IHI, n.d.), including Plan-Do-Study-Act (PDSA) cycles that would allow the team to test different strategies while applying lessons learned from previous cycles (IHI, n.d.). To scale up, leadership must consider human capability, resources, data-collection, and reporting systems when scaling up. To sustain improvements, leadership must be devoted to continuously supporting team members, evaluating measures, sharing successes with the public, and sustaining relationships.

The commissioners will need to leverage community partners for effective and sustainable impact, forming a co-design team of previously identified stakeholders. Co-design is a valuable approach to understand and incorporate the diverse perspectives of community partners to find effective solutions for challenges in the built environment (Hatton et al., 2020). The use of co-design tools culminate with a design brief that guides the project: the project will seek to ensure that all BCPS students are educated about the risks of vaping and empowered with tools to healthfully cope with stress, while modifying additional aspects of the Burke County built environment including tobacco sales surrounding BCPS campuses, to reduce the accessibility and acceptability of adolescent tobacco usage.

Conclusion

E-cigarette use by Burke adolescents is a challenge that warrants the county commissioners' immediate attention. Consideration of the context surrounding this challenge enhances the ability to leverage possible points of transformation, and highlights the need to increase community awareness and education. By implementation of programming that is community-led, Burke County residents could be engaged in community planning to determine possible zoning policy regulations for tobacco sales and marketing. Through modification of the built environment, Burke County can reduce accessibility and acceptability of adolescent tobacco use. Our youth deserve our collective efforts and our community's health depends on it.

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APPENDIX A: COMMON PROPOSAL TABLES AND FIGURES

Figure A.1: Rich Picture

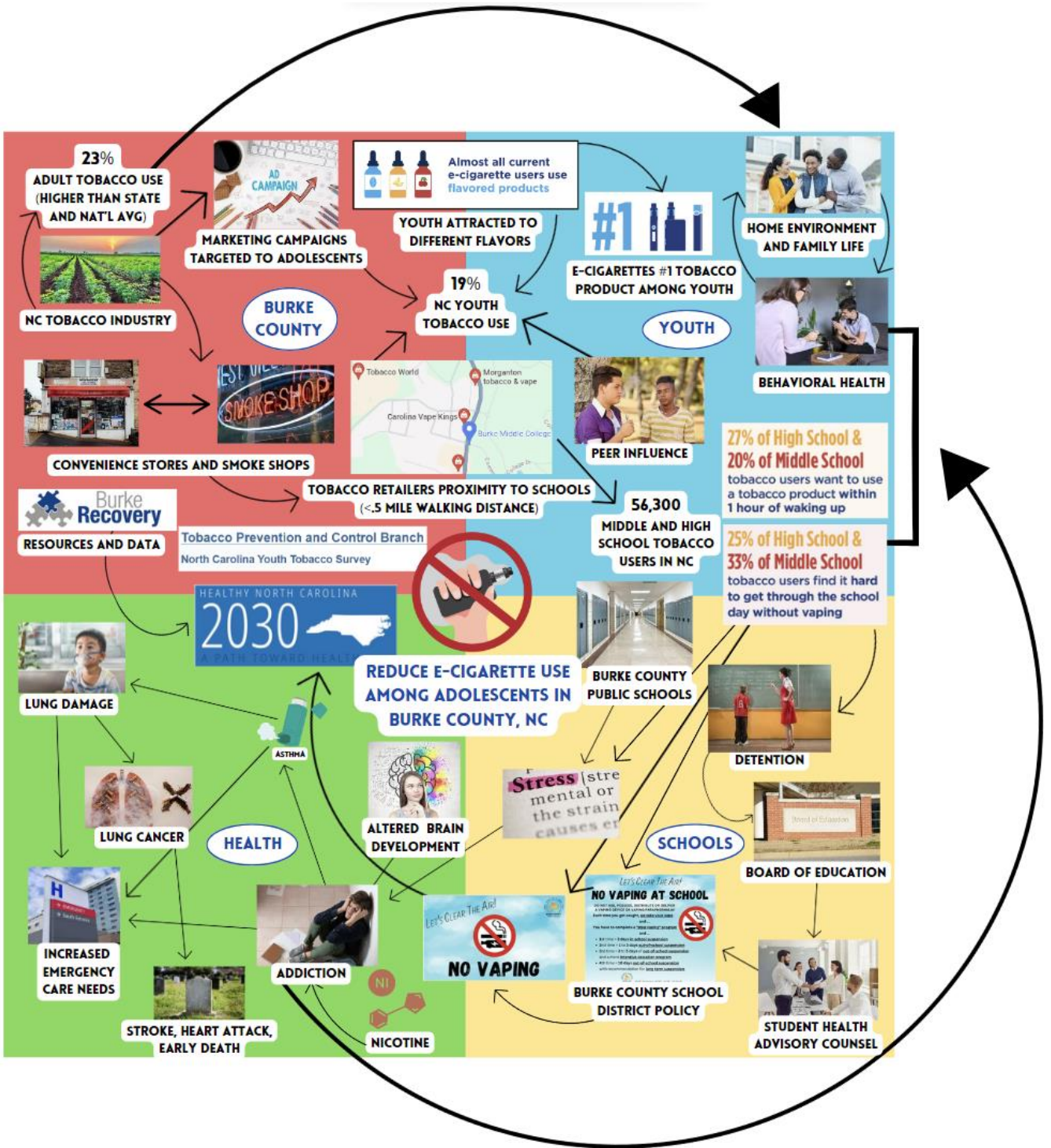


Figure A.2: Group Presentation



Kalli: Thank you, County Commissioners, and esteemed colleagues for the opportunity to present today. I am Jessica Kalli Fortune-Ball,
Cokie Caviness
Ashley Pyo
Richaun Riddick

Kalli: Our presentation today is on the modification of the built environment to reduce adolescent e-cigarette use in Burke County, NC.

Agenda

- Overview
- Contextual Analysis
- Recommendations for Action

Kalli: During this proposal, we'll highlight the importance of addressing the built environment to reduce adolescent e-cigarette use in Burke County. We'll discuss the context that surrounds this challenge, including factors in the built environment that encourage adolescents to use e-cigarettes. Then we will share recommendations for action and reiterate why this is important to address.

Key Terms

Neighborhood and Built Environment

Adolescent (10-19)

E-Cigarette/Vape - tobacco product

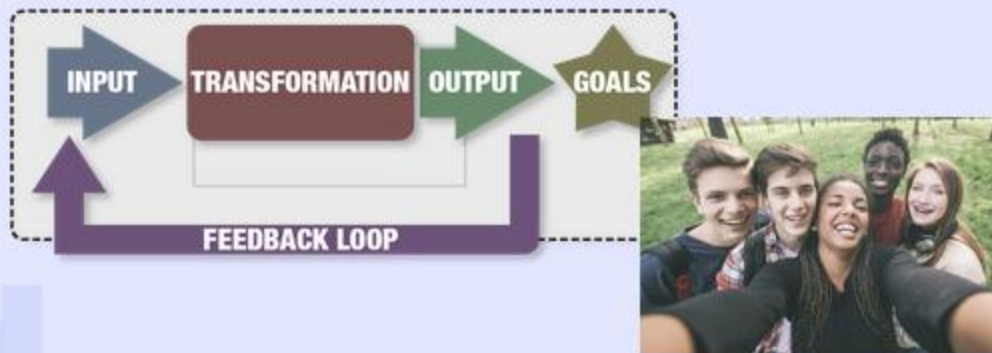


Kalli: Addressing the built environment means looking at the neighborhoods where people are born, live, work, learn, worship, play and age. According to Healthy People 2030 “The neighborhoods people live in have a major impact on their health and well-being (Healthy People 2030, n.d.)”.

Adolescent for this presentation means people ages 10-19.

E-cigarettes, or electronic cigarettes, are also known as vaping. You can see examples of e-cigarettes on the slide. All of these terms refer to a form of tobacco use, which includes nicotine and other chemicals in tobacco.

Methods



Kalli: In order to address the Commissioner’s request, we utilized a variety of methods to analyze the surrounding context and develop the recommendations. This includes a systems analysis and use of quality improvement tools. We conducted a stakeholder analysis and developed strategic leadership accountability plans, all with the end goal of Healthy Burke youth and improved community well-being. Next, we’ll discuss the context surrounding this issue.

Overview: Vaping among adolescents



1 in 8 high school students in NC use a tobacco product



E-cigarettes are the most popular tobacco product among adolescents, almost all using flavored products



25% of high school and 33% of middle school tobacco users in NC face difficulty getting through the school day without vaping

Cokie: E-cigarette use, or vaping, among adolescents has steadily increased over the past decade. In North Carolina, 1 in 8 high school students use a tobacco product, and e-cigarettes are their preferred tobacco product. Vaping has led adolescents to develop nicotine addictions, where 25% of high school and 33% of middle school tobacco users find it difficult to get through the school day without vaping.

Overview: Targeted Marketing

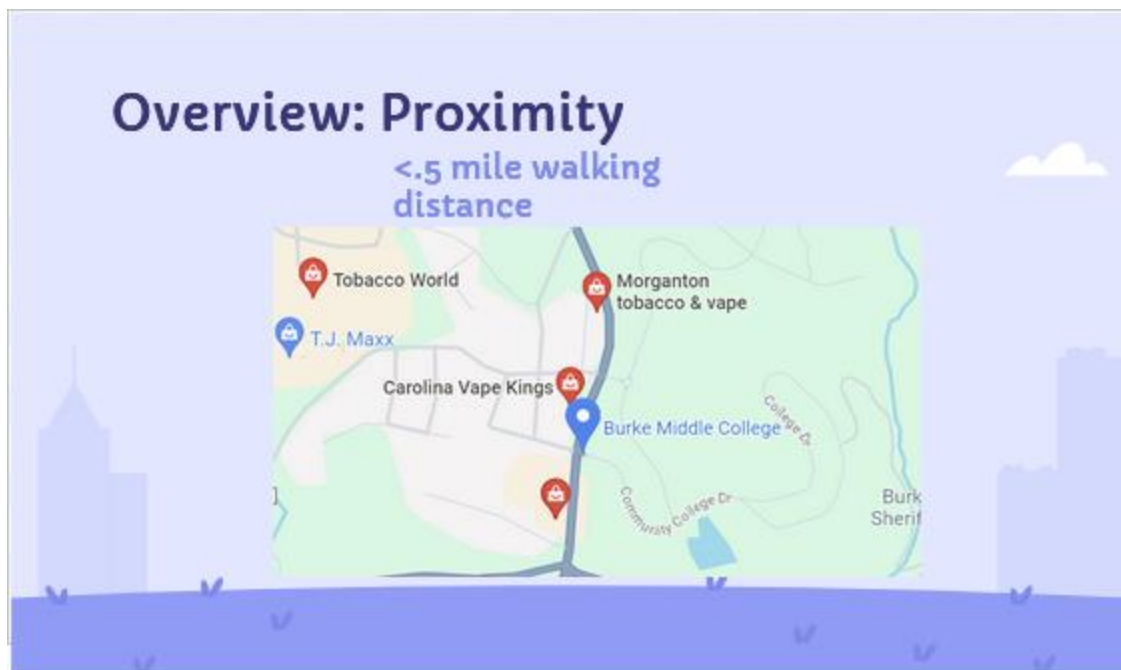


Cokie: E-cigarettes have become so popular among adolescents due to marketing campaigns of fruity flavors, which is a challenge in reducing e-cigarette use among students.

Images via

<https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.istockphoto.com%2Fvector%2Fvape-liquid-poster-colorful-flavor-explosion-realistic-bottles-with-different-fruit-gm1450151539-487153074&psig=AOvVaw10BoEYni51vo7WvY4N8sWM&ust=1711493616184000&source=images&cd=vfe&opi=89978449&ved=0CBiQjRxqFwoTCLiZhNrAkiUDFQAAAAAdAAAAABAR>

<https://www.google.com/url?sa=i&url=https%3A%2F%2Fbouvape.en.made-in-china.com%2Fproduct%2FWJFYelyUgAkX%2FChina-Electronic-Cigarette-Disposable-Vape-Air-Glow-Box-with-13-Fruit-Flavors-7000-Puffs.html&psig=AOvVaw10BoEYni51vo7WvY4N8sWM&ust=1711493616184000&source=images&cd=vfe&opi=89978449&ved=0CBiQjRxqFwoTCLiZhNrAkiUDFQAAAAAdAAAAABAJ>



Cokie: Another aspect of this issue is proximity. Here is a map showing 3 smoke shops less than half a mile to Burke Middle College, one of the high schools in the district. These stores are easily within walking distance for students, not including convenience stores or grocery stores that also sell tobacco products.

Image via

Google. (n.d.). [Google maps showing locations of tobacco retailers near Burke Middle College]. Retrieved February 20, 2024, from <https://www.google.com/maps/search/smoke+shops+near+burke+middle+college/@35.723719,-81.6996548,15z?entry=ttu>

Overview: Anti-Vaping Policy



Prohibits any vaping paraphernalia on school grounds

Consequences:

- Confiscation of device
- Cessation program
- In-school and out-of-school suspension

Cokie: In 2023, the Burke County Public Schools board decided to implement an anti-vaping policy after seeing an increase in e-cigarette use at schools during the past few years. The first of its kind in the county, the policy confiscates tobacco products and outlines other consequences, such as a cessation program or suspension.

Overview: Health Outcomes

Short-term: Stress to respiratory and cardiovascular system, such as trouble breathing or chest pain



Long-term: Nicotine addiction, cancer, damage to lungs, immune function, cardiovascular system

Cokie: While adolescents find the fruity flavors of e-cigarettes appealing, the negative health outcomes of e-cigarette use are less apparent. Adolescents can suffer from acute effects like trouble breathing or chest pain. However, long-term effects are concerning, such as nicotine addiction leading to cancer and damage to lungs, immune function, or the cardiovascular system.

Sources:

North Carolina Department of Health & Human Services (NCDHHS). (2023). 2022 North Carolina Youth Tobacco Survey Middle & High School Fact Sheet.

<https://tobaccopreventionandcontrol.dph.ncdhhs.gov/data/yts/docs/2022-NCYTS-Factsheet-Infographic.pdf>

Overview: Burke County

Smoking prevalence

19% of adolescents in Burke County, compared to 16% in NC



Youth Perceptions

- Many believe that vaping is normal and not dangerous
- School officials are underestimating actual number of students that use e-cigarettes

Cokie: It is important to understand the cultural norms around smoking, since 19% of adolescents smoke in Burke County, compared to 16% in NC. These norms help shape youth perceptions, as adolescents believe that vaping is normal and not dangerous. In addition, students indicate that more of their peers are vaping than are caught by school officials.

Overview: Burke County Resources

E-cigarette
education
for adolescents



Zoning Board

Community Development
Department

Cokie: Burke County offers various resources to help combat this issue, such as e-cigarette education for adolescents to address harmful perceptions. To modify the built environment, the Zoning Board and Community Development Department can provide guidance on the regulation of land use, especially for the proximity of tobacco retailers to schools.

Context



Stakeholder Engagement

Diverse group of partners: students, parents, school officials, health professionals, zoning officials



Leadership

Effective leadership to ensure that community partners are included and valued



Quality

Quality improvement that holds community partners accountable



Systems approach

Address SDOH as a multifaceted issue that requires stakeholder engagement to find a holistic solution

Cokie: Moving forward to address this challenge, commissioners must consider stakeholder engagement and include a diverse group of partners. Exhibiting effective leadership will ensure that community partners feel valued, while adopting quality improvement measures will help hold stakeholders and leadership accountable. Finally, assuming a systems approach will ensure that a holistic solution to this complex issue is found.

Programs & Policy Development



Educate

Implement comprehensive education and smoking cessation programs in collaboration with the BCHD to address the rising rates of adolescent e-cigarette use



Partner

Partner with zoning officials to develop and enforce policies regulating the density of tobacco retailers near schools to reduce accessibility to e-cigarettes for youth



Advocate

Advocate for stricter marketing regulations targeting e-cigarettes, especially flavored vape cartridges aimed at young people

Ashley: The recommended approach to programs and policy development includes education through comprehensive education and smoking cessation programs in collaboration with the Burke County Health Department, partnership with zoning officials to develop and enforce policies regulating the density of tobacco retailers near schools, and advocating for stricter marketing regulations targeting e-cigarettes, especially flavored vape cartridges aimed at the youth, to further discourage use among adolescents.

Engagement & Accountability Plan

Who	Why	How
<ul style="list-style-type: none">• Adolescents• Parents• School Officials• BCPS• Healthcare Professionals• Zoning Officials• Local Business Owners	<ul style="list-style-type: none">• Provide unique perspectives and expertise• Role in shaping school, home, and overall built environment	<ul style="list-style-type: none">• Surveys• Focus Groups• Community Forums• Workshops and Training Sessions

Ashley: Here is the Engagement & Accountability Plan which outlines how we recommend the involvement of key stakeholders. The plan begins with understanding the experiences of adolescents through surveys and focus groups. Parents will provide crucial perspectives, shaping both home and school environments, while school officials will enforce policies and contribute on-the-ground insights. The Burke County Public School Board will guide high-level decisions, while healthcare professionals offer expertise on health implications. Zoning officials will regulate retailer density, and local business owners will be educated on economic and legal ramifications. This comprehensive approach ensures that all stakeholders are actively engaged in combating this pressing public health issue.



Ashley: Here is our recommendation for the Initiative Leadership Strategy, emphasizing the importance of collaboration, communication, monitoring, evaluation, and adaptation. By bringing together key stakeholders such as Burke County Public Schools, parents, adolescents, healthcare professionals, and zoning officials, together we can leverage collective expertise to address adolescent e-cigarette use. Clear communication channels and decision-making processes ensure everyone is informed and involved, fostering a collaborative environment. Together we can also track metrics and indicators to measure outcomes, enabling data-driven decisions to guide our future actions. Lastly, we recommend committing to continuous refinement of the approaches and strategies to effectively promote a healthy built environment.

Understanding Why This Is Important

Our Neighborhood and Environment

There are 16 smoke shops and tobacco vendors located less than a ten-minute drive from middle and high schools

Public Health Epidemic

Burke County's adolescent smoking rates are higher than the state and U.S. average.

Better Adolescent Health

Increase in adolescent mental and physical health, lowering stress levels.

Richaun: As public health partners, we understand focusing on modifying the built environment to reduce adolescent e-cigarette use in Burke County has its challenges. Collaboration, policies, and programs are needed to address the root causes and lower adolescent e-cigarette use. Healthy North Carolina 2030 Report stated, "E-cigarette use among young people has become epidemic in North Carolina and poses a public health threat." There are sixteen smoke shops within Burke County all less than a ten-minute drive from the middle and high schools in the area. By working together and using our expertise, we can advocate, educate, and partner to create an overall healthier neighborhood and built environment and give our adolescent population, our future leaders, a chance at achieving better overall health.

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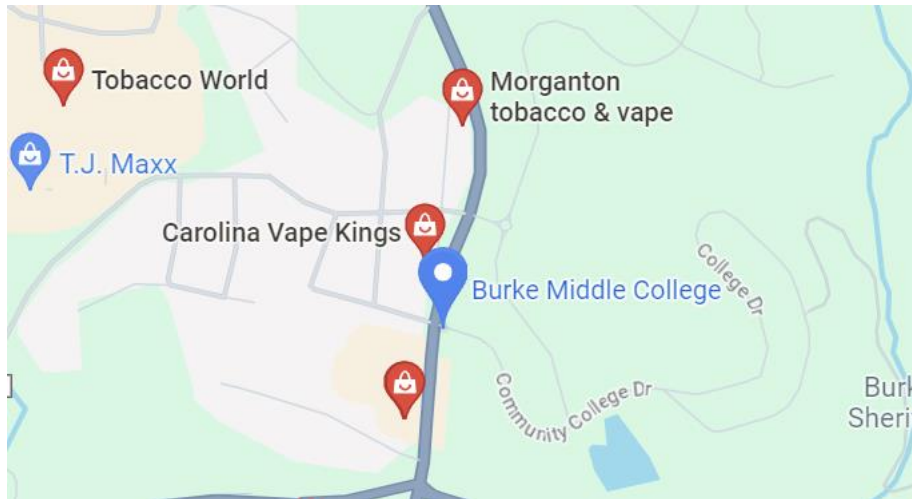
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Richaun- Here are our references used. Thank you for your time and consideration for listening to this proposal. We are now providing the space to answer any questions you may have.

Figure A.3: Map Displaying Tobacco Retail Shops within 0.5 mile of Burke Middle College



Note. The three smoke retail shops are Morganton Tobacco & Vape, Carolina Vape Kings, and Tobacco Barn #1.

Google. (n.d.). [Google maps showing locations of tobacco retailers near Burke Middle College]. Retrieved February 20, 2024, from <https://www.google.com/maps/search/smoke+shops+near+burke+middle+college/@35.723719,-81.6996548,15z?entry=ttu>

Table A.1: Stakeholder Analysis Grid

Partner	Interest	Impact	Engagement
Adolescents	- gain education about vapes and how to - prevent negative health outcomes gain a healthier environment in and around school	High interest/ Moderate influence	- participate in co-design meetings - provide input on adolescent perceptions throughout the process
Parents	- Health of their children build healthy habits and environments (school and home)	High interest/ Moderate influence	- participate in co-design meetings - provide information on home environment
School administrators	- Provide healthy environment for students - reduce illegal behavior on school grounds - reduce suspensions that disrupt learning	High interest/ High influence	- Enforce anti-vaping policy - Observe and monitor implementation
School board member	- Provide healthy environment for students reduce illegal behavior on school grounds	Moderate interest/ High influence	- provide input on county resources - make decisions on programs and implementation
School Counselors and Nurses	- health of students' mental well-being and stress management among students	High interest/ Moderate influence	- observe student behavior within school environment - outreach with students - help develop cessation program
Behavioral health professional	- Address stress and triggers for students reduce nicotine dependence	High interest/ Moderate influence	- help develop cessation program - create education materials
Healthcare professional	- Improve adolescent health - reduce adverse health effects from nicotine reduce adolescents' exposure to tobacco products	High interest/ Moderate influence	- help develop cessation program - create education materials
Zoning Officials	- Responsible for addressing land use questions with the public - Responsible for building codes and planning for development, including public health	Moderate interest/ Moderate influence	- Can help advise co-design team on regulations and zoning
Local business owners	- Economic effects on business understand legal ramifications if adolescents are sold e-cigarette paraphernalia	High interest/ Low influence	- inform of changes in regulations or policies through meetings and emails

Table A.2: RASCI Analysis of Project Goals

RASCI Levels	Project Goals		
Who is...	Goal 1- Steering committee membership will include at least five different types of member representation for at least 80% of the meetings for one year.	Goal 2- Increase the number of active* committee members by 20% over the first year of the program. *Active defined as participating in at least 70% of meetings and/or functions.	Goal 3 - Youth representatives will lead at least 25% of the program meetings, including agenda setting and invitee list.
Responsible	<ul style="list-style-type: none"> ● Student Health Advisory Council (SHAC) ● Burke Recovery 	<ul style="list-style-type: none"> ● SHAC ● Burke Recovery 	<ul style="list-style-type: none"> ● SHAC ● Parents
Accountable	<ul style="list-style-type: none"> ● SHAC ● Health Department ● School District 	<ul style="list-style-type: none"> ● SHAC ● Health Department ● School District 	<ul style="list-style-type: none"> ● SHAC ● Health Department ● Parents ● Students
Supportive	<ul style="list-style-type: none"> ● Parents ● Students ● Pediatricians and Health Care Providers 	<ul style="list-style-type: none"> ● Parents ● Students ● Health Department 	<ul style="list-style-type: none"> ● School Staff ● Parents
Consulted	<ul style="list-style-type: none"> ● Vape shop owners ● Zoning officer ● School Nurse ● Tobacco industry marketing (focusing on local staff who display tobacco marketing in tobacco shops) 	<ul style="list-style-type: none"> ● Local faith-based organization leaders ● Adult Participants of Burke County’s Tobacco Cessation program 	<ul style="list-style-type: none"> ● School Administration ● Members of school government
Informed	<ul style="list-style-type: none"> ● Parents ● Students ● School District 	<ul style="list-style-type: none"> ● Parents ● Wider program committee 	<ul style="list-style-type: none"> ● Parents ● School District ● Wider program committee

APPENDIX B: COKIE CAVINESS' INDIVIDUAL DELIVERABLES

Appendix B.1: Social Determinant of Health Analysis

Social Determinant of Health (SDOH)

Public health officials have emphasized the importance of social determinants of health (SDOH) as critical entry points to improving health for decades (Braveman and Gottlieb, 2014). Neighborhoods and the built environment are crucial as they encompass the “health and safety in the places where people are born, live, learn, work, play, worship, and age” (Healthy People 2030, n.d.). For example, schools are a common site where adolescents engage in tobacco use with their peers (Dai, 2021). School policies and the surrounding built environment impact tobacco use, as school proximity to tobacco retailers has been associated with increased smoking prevalence (Henriksen, et al. 2008). In the last decade, a tool intended to promote smoking cessation, e-cigarettes, has become a rising concern among health experts for their popularity among adolescents (Hamberger and Halpern-Felsher, 2020). E-cigarettes, or vapes, are tobacco products that contain nicotine (CDC, 2023).

The connection between the SDOH of the built environment and e-cigarette use can be seen in Burke County, NC, as the county school board implemented an anti-vaping policy for public schools in 2023 (Burke County Public Schools [BCPS], 2023). By one high school, Burke Middle College, three tobacco shops are within half a mile (see Figure B.1.1.). Tobacco retailers are not exclusive to smoke shops - convenience stores and grocery stores also sell tobacco products. In addition, the school board highlighted the marketing of fruity flavor options for e-cigarettes that appeal to adolescents (BCPS, 2023).

Adolescents are also attracted by a perception that e-cigarettes as less harmful than traditional cigarettes (Hamberger and Halpern-Felsher, 2020). However, according to the CDC (2023), vaping is still unsafe, especially for youth: e-cigarettes contain nicotine that is addictive and chemicals that are harmful. Effects of vaping can be immediate, such as respiratory distress or chest pain (Gordon, et al., 2020). In the long term, e-cigarette use can lead to impaired brain development, altered immune function, respiratory

disease, or cancer (Hamberger and Halpern-Felsher, 2020). Furthermore, e-cigarette use can lead to nicotine addiction and the onset of smoking combustible cigarettes (Hamberger and Halpern-Felsher, 2020).

Geographic and historical context

Burke County lies in the western part of North Carolina, home to numerous mountain peaks and protected park lands (Burke County, n.d.-a). While the county is identified as urban by the North Carolina State Data Center (2018), 42.7% of the population still lives in rural areas (North Carolina Department of Health & Human Services, 2023). According to County Health Rankings and Roadmaps (2024), 23% of adults smoke in Burke County, compared to 16% of adults among the nation. The higher prevalence of smoking alludes to North Carolina's history of using tobacco as a cash crop, with tobacco factories once operating throughout the state, including in Burke County (Yeargin, 2006). In addition, North Carolina state law prohibits the sale of tobacco products to those under 18 years of age, while federal law prohibits the sale to those under 21 (North Carolina Department of Public Safety, n.d.). Tobacco retailers must follow federal law, but NC will not necessarily enforce that law, creating a grey area where high school seniors may potentially purchase tobacco products.

To address smoking, Burke County offers tobacco cessation support to residents that includes education on the effects of smoking and strategies to manage triggers (Burke County, n.d.-c). Also, the recent anti-vaping policy in schools prohibits e-cigarette devices from school grounds and activities (BCPS, 2023). If a student is caught with an e-cigarette, their device will be confiscated, and the student will be placed in suspension or a cessation program (BCPS, 2023). Concerning the built environment, Burke County's Zoning Board of Adjustment and the Community Development Department are responsible for regulations concerning land use (Burke County, n.d.-b).

Priority Population

Adolescents attend five middle schools and four high schools throughout the county. BCPS students are 62.6% white, 20.1% Hispanic, 6.2% multiracial/other, 5.9% Asian, and 4.2% Black (EdNC, 2024). In 2023, BCPS implemented an anti-vaping policy after observing an increasing trend in vaping at

schools, which has led to disruptions to the school day and a less healthy environment for students (BCPS, 2023). In March of 2023, the school system had already documented 353 cases of disciplinary action for vaping on school grounds for that year (Koon, 2023). Students disciplined came from all three age divisions: elementary, middle, and high school (Koon, 2023). As such, adolescents aged 10-19 in Burke County are a priority group to focus on for decreasing e-cigarette use.

Measures of Problem Scope

The BCPS Board shared that an increase in e-cigarette use has been observed in the past few years (BCPS, 2023), but the board did not provide any supporting evidence or data. Consequently, state data can be used to understand the scope of this SDOH. In 2022, the North Carolina Department of Health and Human Services (NCDHHS) reported that e-cigarettes were the most popular tobacco product among students. Among 73,900 high school tobacco users, 43,800 (59.3%) of them used e-cigarettes compared to cigars, cigarettes, or nicotine pouches; similarly, 46.6% of middle school tobacco users preferred e-cigarettes (see Appendix B.1.2). Between 2011 and 2019, e-cigarette use increased by 510% among middle school students and 1129% among high school students (NCDHHS, 2019). Overall, 20.9% of high school and 6.1% of middle school students use e-cigarettes (NCDHHS, 2019; See Appendix B.1.3). Measures of e-cigarette dependence were also reported: 25% of high school and 33% of middle school students face difficulty attending a school day without vaping (NCDHHS, 2022).

National data can be used to understand health disparities. E-cigarette use has been found to be most common among American Indians/Alaskan Natives and Native Hawaiians/Other Pacific Islanders (Odani, Armour, and Agaku, 2018). Among adults, Black tobacco users experience higher mortality rates related to tobacco use compared to their white counterparts (Ho and Elo, 2013). While Burke County is predominantly white (US Census Bureau, 2023), it is important to consider differences in tobacco use among adolescents that can contribute to health disparities later in life.

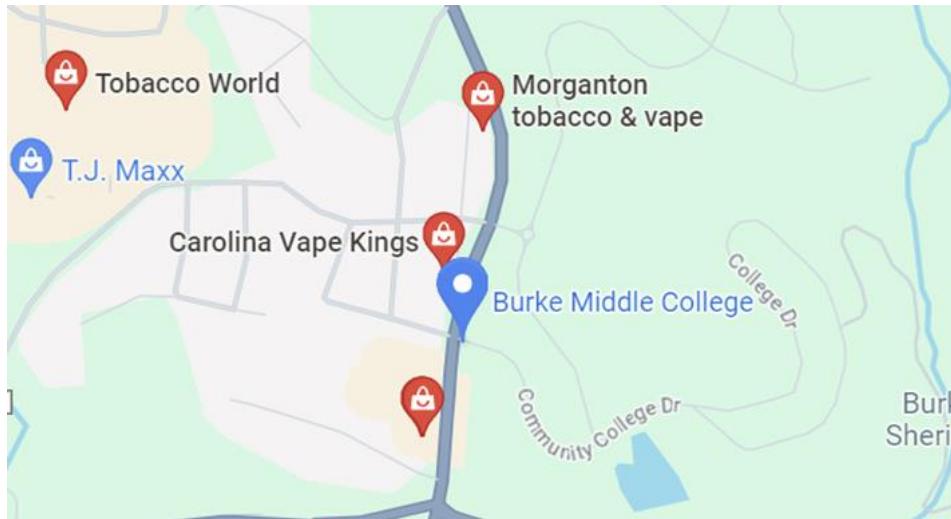
Rationale/Importance

The marketing of flavors and proximity of tobacco retailers have contributed to increased e-cigarette use among adolescents in Burke County (BCPS, 2023; NCDHHS 2021). Consequently, it is vital

that Burke County makes e-cigarette use among adolescents a public health priority. Failing to modify the built environment to reduce e-cigarette use leaves youth vulnerable to the negative health outcomes of e-cigarette use, including the onset of smoking cigarettes, nicotine addiction, and lung damage (Hamberger and Halpern-Felsher, 2020). Adolescents should be able to enter adulthood without lasting effects from e-cigarette use during their youth. Burke County has taken a step to address this issue with its no-vaping policy in schools, but collecting more information on e-cigarette use, understanding the issue better, and engaging with stakeholders can help Burke County develop other sustainable strategies that help adolescents.

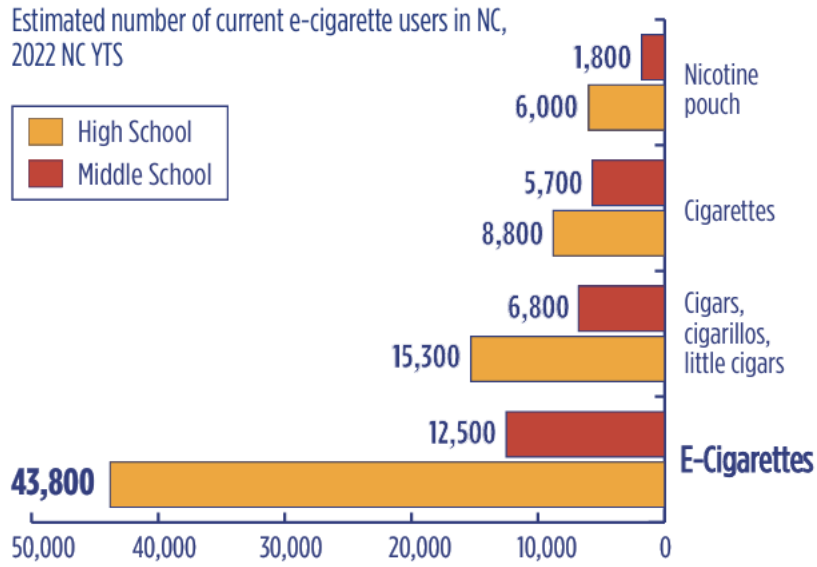
Appendix B.1.a: SDOH Individual Tables and Figures

Figure B.1.1: Google Maps displaying tobacco retail shops within .5 mile of Burke Middle College



Note. The three smoke retail shops are Morganton Tobacco & Vape, Carolina Vape Kings, and Tobacco Barn #1. This image is from Google. (n.d.). [Google maps showing locations of tobacco retailers near Burke Middle College]. Retrieved February 20, 2024, from <https://www.google.com/maps/search/smoke+shops+near+burke+middle+college/@35.723719,-81.6996548,15z?entry=ttu>

Figure B.1.2: Estimated number of current e-cigarette users in NC, 2022

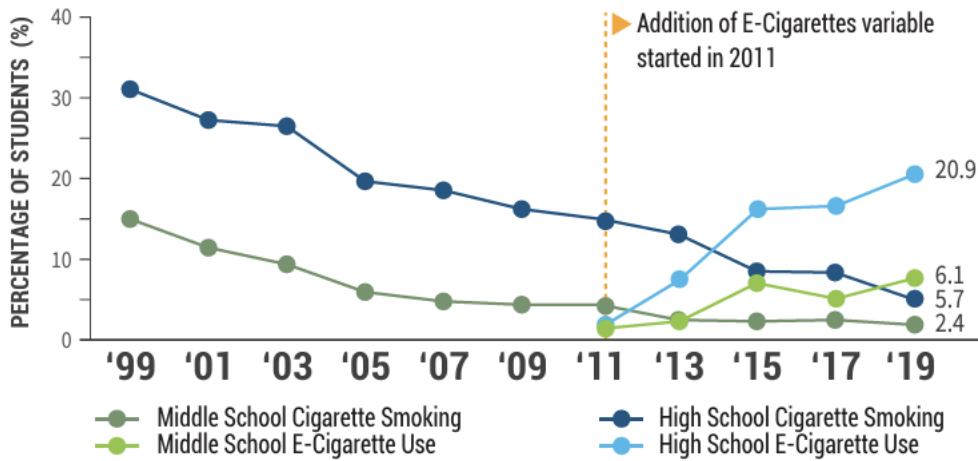


Note. This image is from North Carolina Department of Health & Human Services (NCDHHS). (2021). *2019 North Carolina Youth Tobacco Survey Middle & High School Fact Sheet.*

<https://tobaccopreventionandcontrol.dph.ncdhhs.gov/data/yts/docs/YouthTobaccoSurveyFactSheet-2019.pdf>

Figure B.1.3: Trends in E-cigarette use among middle and high school students

NC MIDDLE & HIGH SCHOOL CURRENT USE OF CIGARETTES & E-CIGARETTES, NC YTS, 1999-2019



Note. This image is from North Carolina Department of Health & Human Services (NCDHHS). (2023). *2022 North Carolina Youth Tobacco Survey Middle & High School Fact Sheet*. <https://tobaccopreventionandcontrol.dph.ncdhhs.gov/data/yts/docs/2022-NCYTS-Factsheet-Infographic.pdf>

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Appendix B.2: Community Partner Analysis

Introduction

E-cigarette use among adolescents in Burke County is a rising concern among the Burke County School Board and school administrators, in which an anti-vaping policy was implemented in 2023 (Burke County Public Schools, 2023). Use of e-cigarettes and exposure to the aerosols they produce can adversely affect adolescents' brain development, respiratory system, and immune function (Hamberger and Halpern-Felsher, 2020). E-cigarettes, or vapes, do contain nicotine that can be addictive and can precede the onset of smoking cigarettes (CDC, 2023). As schools are a common site where adolescents engage in vaping (Dai, 2021), creating a healthy school environment for adolescents is paramount in tackling this social determinant of health (SDOH). Highlighting the built environment surrounding schools also brings attention to the close proximity between tobacco retailers and individual schools in the county; for example, there are three tobacco shops within half a mile of Burke Middle College, one of the public high schools in the area (see Figure B.2.1). Calling on various partners and stakeholders in the community will be essential to properly address this health concern.

Community Partner Mapping

Stakeholder Analysis Grid

A stakeholder analysis grid is used to visually map and describe community partners that will be important to include for this issue (see Table B.2.1). The grid allows us to understand the interests and potential impact of partners, as well as ways to garner support or anticipate challenges when engaging with them. Our team proposes that County Commissioners include representatives for adolescents, parents, school counselors, school administrators (i.e. principals), the school county board, healthcare professionals, behavioral health professionals, zoning officials (i.e. the Planning Board or Community Development Department), and local business owners in a task force that addresses e-cigarette use among adolescents. We will seek school counselors and administrators from elementary, middle, and high schools.

Rationale

As the priority population, adolescents are a vital group of community partners to include on the task force. This partner would provide input on adolescents' daily lives and experiences that may lead them to vape. In addition, their input would help ensure that any proposals resonate with the intended group, improving buy-in and saving money or resources on a tactic that would not meet our goals. Along with adolescents, parents are important to include, as they can influence both the school and home environment of adolescents. Parents can provide additional insight as caretakers for adolescents that provide for them and spend time with them.

School administration, such as principals or vice principals, are another community partner that must be included in the task force. In working to develop a healthy environment for students, school administration enforces policies and directly interacts with students. Also, school officials can provide on-the-ground input on the behavior of adolescents and monitor the effects of any implemented programs.

School counselors and nurses are also important figures in the school environment that can offer significant guidance for the task force. They interact with adolescents and can provide information on factors that may encourage students to vape on school grounds or how students obtain tobacco products. Counselors and nurses can also be helpful in creating a cessation program for students, such as educational tools or documents.

The Burke County Public Schools Board would also need a representative on the task force. While they are not physically situated close to adolescents like the school administration or counselors, they still make higher-level decisions that impact school environments. For example, they decided to implement the 2023 anti-vaping policy in schools.

Beyond school-affiliated partners, healthcare professionals would also be beneficial to the task force, such as physicians, pediatricians, health department workers, and behavioral health professionals. Their input is needed for any tobacco education or cessation programs since they have observed or learned about the negative outcomes of tobacco use. In addition, healthcare professionals can provide evidence-based strategies or programs that can help adolescents stop using tobacco products.

Zoning officials should be on the task force as well. In Burke County, zoning officials are responsible for land use matters, advising the Board of Commissioners, and reviewing construction applications (Burke County, n.d.). Their expertise will be necessary for understanding how to alter or change the built environment around schools.

Local business owners also hold a stake in potential regulations or policies that involve vaping, so their input is important to consider. They face both economic and legal ramifications, such as loss of sales revenue or citations for minors accessing e-cigarette paraphernalia from their stores. They can also provide more information on understanding e-cigarette devices, cartridges, costs, and the flavor options that appeal to youth.

Equitable representation and participation

In engaging with adolescents, being sensitive to confidentiality and students' fear of punishment will be important when seeking representation from them. Their input needs to be taken seriously by the task force for the success of any endeavor. The issue of expertise and authority applies overall, as counselors or nurses may defer to school administrators, or administrators may defer to a board member. Ground rules and shared understanding should be fostered to ensure that each partner feels like a valued member of the task force.

Reflections and Conclusions

For any of the proposed partners, it is important to ask them if they have observed any effects from the recently implemented anti-vaping policy. How many students have been caught and faced consequences? How easily do adolescents obtain tobacco products from surrounding retailers? Are e-cigarette sales static for business owners? What else can be done?

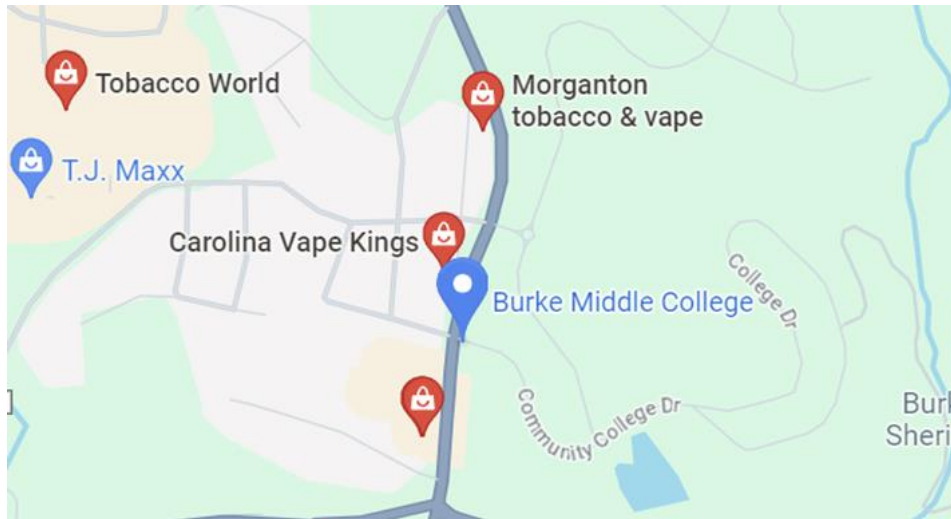
This proposed group of community partners is beneficial due to the multiple types of stakeholders, as many factors and actors influence the school environment. However, the list may be limited in scope, as we have yet to directly engage stakeholders; for example, once partners are contacted, they may suggest another stakeholder that we failed to consider or include. Listening to their suggestions in the future will be essential. Another important consideration is the involvement of local business

owners: how do we build a relationship with this partner, when we might end up negatively affecting their business?

Going forward, County Commissioners will have to be intentional and transparent with any community partner they include on the task force or the program overall. While a diverse group of community partners is advantageous for providing different vantage points, power dynamics can still deter the development of a collaborative and safe space for all participants. Building relationships and trust with stakeholders will help ensure sustainable changes that will reduce e-cigarette use among adolescents in Burke County.

Appendix B.2.a: Community Partner Analysis Individual Figures and Tables

Figure B.2.1: Google Maps displaying tobacco retail shops within .5 mile of Burke Middle College



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Table B.2.1: Stakeholder Analysis Grid

Partner	Interest	Impact	Engagement
Adolescents	- gain education about vapes and how to - prevent negative health outcomes gain a healthier environment in and around school	High interest/ Moderate influence	- participate in co-design meetings - provide input on adolescent perceptions throughout the process
Parents	- Health of their children build healthy habits and environments (school and home)	High interest/ Moderate influence	- participate in co-design meetings - provide information on home environment
School administrators	- Provide healthy environment for students - reduce illegal behavior on school grounds - reduce suspensions that disrupt learning	High interest/ High influence	- Enforce anti-vaping policy - Observe and monitor implementation
School board member	- Provide healthy environment for students reduce illegal behavior on school grounds	Moderate interest/ High influence	- provide input on county resources - make decisions on programs and implementation
School Counselors and Nurses	- health of students' mental well-being and stress management among students	High interest/ Moderate influence	- observe student behavior within school environment - outreach with students - help develop cessation program
Behavioral health professional	- Address stress and triggers for students reduce nicotine dependence	High interest/ Moderate influence	- help develop cessation program - create education materials
Healthcare professional	- Improve adolescent health - reduce adverse health effects from nicotine reduce adolescents' exposure to tobacco products	High interest/ Moderate influence	- help develop cessation program - create education materials
Zoning Officials	- Responsible for addressing land use questions with the public - Responsible for building codes and planning for development, including public health	Moderate interest/ Moderate influence	- Can help advise co-design team on regulations and zoning
Local business owners	- Economic effects on business understand legal ramifications if adolescents are sold e-cigarette paraphernalia	High interest/ Low influence	- inform of changes in regulations or policies through meetings and emails

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Appendix B.3: Continuous Quality Improvement

Understanding the value of Reaccreditation of Local Health Departments through the lens of CQI

Background

E-cigarette use among adolescents in Burke County is a rising concern for the Burke County School Board and school administrators, in which an anti-vaping policy was implemented in 2023 (Burke County Public Schools, 2023). Use of e-cigarettes and exposure to the aerosols they produce can adversely affect adolescents' brain development, respiratory system, and immune function (Hamberger and Halpern-Felsher, 2020). E-cigarettes, or vapes, do contain nicotine that can be addictive and can precede the onset of smoking cigarettes (CDC, 2023). As schools are a common site where adolescents engage in vaping (Dai, 2021), creating a healthy school environment for adolescents is paramount in tackling this social determinant of health (SDOH). Highlighting the built environment surrounding schools also brings attention to the close proximity between tobacco retailers and individual schools in the county; for example, there are three tobacco shops within half a mile of Burke Middle College, one of the public high schools in the area (see Figure B.3.1). Calling on various partners and stakeholders in the community will be essential to properly address this health concern.

Change Concepts

Among the unmet activities identified by the North Carolina Local Health Department Accreditation Board (2023) for Burke County's health department, Activity 10.2 focuses on the "implementation and evaluation of health promotion/disease prevention programs and educational materials targeted to groups identified as at-risk in the community health assessment" (p. 3). To address 10.2, the Burke County Health Department will have to evaluate their work processes and strive for improvement. To develop specific strategies, change concepts are important to consider. These are broad categories of change approaches that can lead to specific ideas, such as eliminating waste or improving workflow (Institute for Healthcare Improvement (IHI), n.d.).

There are various tools to identify change concepts and ideas, such as the driver diagram: this tool explores the influences and drivers for our issue, highlighting components that can be focused on for implementation (IHI, n.d.). For example, what drives the lack of smoking cessation education in the school environment? This may point towards a lack of training among school officials to educate students, prompting a change concept to change the work environment by offering information and training to employees.

Another tool is the Six Thinking Hats activity, which requires members to assume different perspectives: factual, emotional, creativity, positivity, risks, and critical analysis (The de Bono Group, n.d.). Participants can also use the tool to assume different perspectives in general; partners can consider the point of view of other stakeholders, fostering understanding and trust. For example, assuming the hat of critical analysis, the improvement team may consider that the anti-vaping policy that punishes students may not be enough, pointing towards changing the work environment again by looking towards trainings on e-cigarette use to properly education students.

A third tool is the Gemba Walk, where team members take a walk through the school and the surrounding environment, observing processes around e-cigarette use (e.g. walking distances to tobacco retailers, marketing, monitoring of students who vape, suspensions, etc.) (Learn Enterprise Institute, n.d.). During a Gemba Walk, a team member may notice students gather near a convenience store within walking distance to the school to share vapes, outside of school grounds. The change concept could also involve changing the environment, such as working with zoning officials to regulate locations of tobacco retailers or providing school officials with training to educate students on e-cigarette use.

Change Idea and Improvement Model

Using the tools and generating change concepts can lead to multiple change ideas. To address activity 10.2, one idea is to create a training manual for school officials that educates them about e-cigarette use and how to encourage a tobacco-free environment for students. The Model for Improvement (MFI) would be a powerful tool to test and evaluate this change idea in Burke County, especially with the use of Plan-Do-Study-Act (PDSA) cycles (IHI, n.d.). MFI is an iterative process that asks 3 questions:

“What are we trying to accomplish? How will we know that a change is an improvement? What change can we make that will result in improvement?” (IHI, n.d.). These questions will pinpoint the desired changes and actions needed to address activity 10.2.

In exploring these questions, PDSA cycles act as tests for different aspects of change or improvement. For example, the first PDSA cycle of a training manual could test types of educational materials – how helpful would a booklet that teachers or counselors could study on their own be in creating change? The team would observe this test and take measurements to evaluate this strategy, noting what was positive or negative. Next, a new method would be tested, such as training sessions with modules or testing in a different school. Throughout these cycles, lessons learned from the previous cycle would be applied to new ones to continuously improve the process and highlight strategies that were effective.

Scaling Up and Sustainability

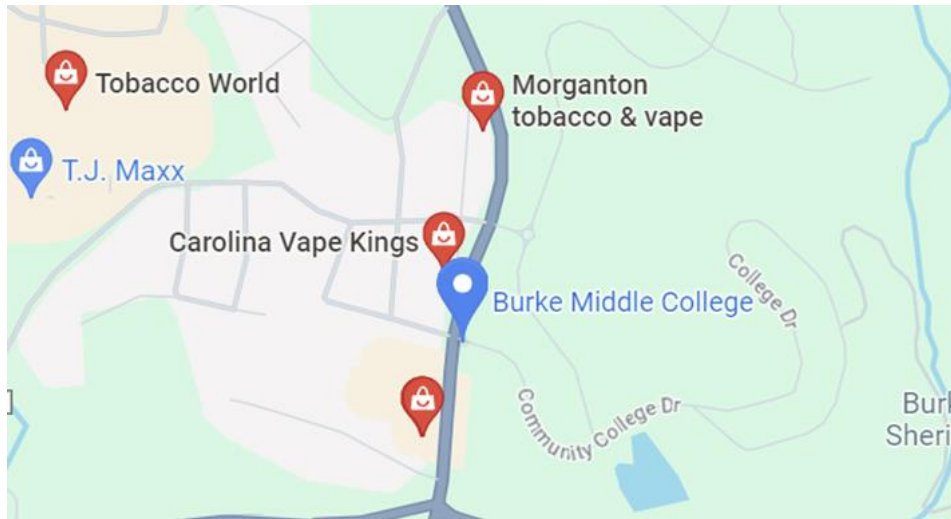
Once the improvement team conducts multiple PDSA cycles testing the change idea and finds improvement, scaling up would be the next step. For example, if the improvement team originally tested at Burke Middle College, scaling up would expand to other high schools, or even to middle schools as well. When preparing the e-cigarette use training for other school officials, the improvement team must consider multiple factors. Human capability and resources are essential, as the workload and schedules of school workers must be considered, as well as who will distribute educational materials. Data-collection and reporting systems must also be supported; evaluation and ensuring that implementation results in improvement should always be included in the process.

Actions to sustain improvement will be important and absolutely necessary to maintain a healthy environment for adolescents. Leaders must be present to continuously monitor implementation and provide support as needed. For the Burke County Health Department, this will look like ongoing meetings with partners and constant evaluation of data measures. If there are new changes to e-cigarettes (i.e. new flavors or changes in the look of the devices), they must be prepared to inform school officials and provide new training materials. A leader must also share the results and improvement with the public to

gain more support for their efforts to decrease e-cigarette use, such as news articles or reviews with local news stations. Periodic displays of success will also keep morale up so that efforts do not stall or fall behind. Finally, a leader should always maintain their partnerships and work to cultivate new relationships, such as meeting with zoning officials if a business area is being developed near a school.

Appendix B.3.a: Continuous Quality Improvement Individual Figures and Tables

Figure B.3.1: Google Maps displaying tobacco retail shops within .5 mile of Burke Middle College



Note. The three smoke retail shops are Morganton Tobacco & Vape, Carolina Vape Kings, and Tobacco Barn #1. This image is from Google. (n.d.). [Google maps showing locations of tobacco retailers near Burke Middle College]. Retrieved February 20, 2024, from <https://www.google.com/maps/search/smoke+shops+near+burke+middle+college/@35.723719,-81.6996548,15z?entry=ttu>

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APPENDIX C: JESSICA KALLI FORTUNE-BALL'S INDIVIDUAL DELIVERABLES

Appendix C.1: Social Determinant of Health Analysis

Social Determinant of Health

The neighborhoods in which people live have profound impact on health, with a wide range of factors that local, state, and federal policy and programming can influence (Centers for Disease Control and Prevention [CDC], 2022). The environment creates structures and spaces that inform the lived experience, such as having highways cut through neighborhoods without crosswalks versus having sidewalks and bike lanes on the roads for increased opportunity to walk and bike (Healthy People 2030, n.d.). By addressing environmental and neighborhood risks through policy and interventions (CDC, 2022), the environment can either encourage or discourage individual behaviors, which then contributes to the overall health of the community (County Health Rankings, 2024).

Within the social determinant of Neighborhood and Built Environment, one of these higher risk behaviors is tobacco use (County Health Rankings, 2024). Tobacco use remains a leading cause of preventable disease, morbidity, and mortality in the United States (US) (Buettner-Schmidt, Miller & Maack, 2019). Tobacco use harms almost every organ in the body (CDC, 2023) with tobacco use causing cancer, heart disease, stroke, lung disease, diabetes, and other chronic illnesses (CDC, 2022). It causes increased risk of short-term and long-term effects, ranging from emergency room visits for asthma flare-ups, to heart disease and chronic obstructive pulmonary disease that can result in death (Buettner-Schmidt, Miller & Maack, 2019).

The built environment of Burke County, North Carolina includes the number of tobacco shops and retail locations where individuals can purchase tobacco. As research shows that almost nine out of ten adults who smoke cigarettes daily initiated tobacco use before age 18 (CDC, 2023), and almost 13% of US high schoolers used tobacco in 2023 primarily via e-cigarettes/vaping (CDC, 2023), examination of adolescent (ages 10-19) access to tobacco demands attention. The proximity of tobacco shops with the five middle schools and four high schools of Burke County Public Schools is notable, such as a 0.7 mile

walkable distance from Burke Middle College High School to Morganton Tobacco and Vape (Mapquest, 2024) (see Figure C.1.1).

Geographic and Historical Context

Discussion of tobacco use in Burke County requires consideration of the geography, along with cultural and historical context that impacts the built environment. Burke County is in the foothills of the Blue Ridge Mountains in the western part of North Carolina (NC), covering approximately 514 square miles and ranging in elevation from 900 to 4,300 feet above sea level (Burke County, 2022). In 2020, the population was 87,570 people, with 85.9% White persons and 17.8% people under the age of 18 (United States Census Bureau, 2023) (see Table C.1.1).

The county seat is Morganton, with a population of approximately 17,000 people (United States Census Bureau, 2023). While the population of Morganton prevents Burke from being classified solely as a rural county by the NC Department of Health and Human Services (NCDHHS, 2019), 42.7% of Burke residents live in a rural area, with 500 or fewer people per square mile (County Health Rankings, 2024). When compared to North Carolina and the US, Burke County has a higher proportion of White people, more poverty, less education, less access to healthy foods and exercise opportunities, and less broadband internet access (United State Census Bureau, 2020; County Health Rankings, 2024) (see Tables C.1.1 and C.2.2). Within Burke County Public Schools, 65% of students were eligible for free lunch for the 2022-2023 school year with eligibility determined by family income (Burke County, 2022).

Consistent with persistent disparities of higher tobacco use in rural populations than urban (Buettner-Schmidt, Miller & Maack, 2019), adult smoking prevalence in 2023 Burke County (23%) is much higher than that for North Carolina (17%) (County Health Rankings, 2024). Higher smoking prevalence, as seen in Burke, is associated with lower incomes, lower education levels, less access to medical resources, and less access to health communication (Roberts et al., 2016), which is also true for Burke when compared to North Carolina overall (County Health Rankings, 2024). Compared with their urban counterparts, rural residents, including Burke residents, have less access to behavioral health providers (in-person or virtual) to address tobacco use and/or mental illness (Roberts et al., 2016).

Rural social networks are more commonly identified by geographic isolation, directly impacting social norms (Roberts et al., 2016). As North Carolina’s history includes many generations with tobacco as the state’s leading cash crop and major source of income (North Carolina Historic Sites, n.d.), tobacco has been normalized into the culture (Buettner-Schmidt, Miller & Maack, 2019), resulting in social norms that increase the likelihood of tobacco use (Roberts et al., 2016). Additionally, targeted tobacco marketing often “promotes masculinity, toughness and outdoors, [which] can further reinforce pro-tobacco norms (Roberts et al., 2016)”.

To counter these pro-tobacco factors, Burke County Public Schools enacted a new anti-vaping policy in August 2023, which established disciplinary procedures for use or possession of electronic cigarettes (e-cigarettes) on school grounds (Burke County Public Schools [BCPS], 2023). The school district has also collaborated with Adolescent Prevention Services of Burke Recovery to create interventions and programming specific to Burke youth (The Morganton Herald, 2023).

Priority Population

Focusing on reducing tobacco use in Burke County youth (ages 10-19) has positive short- and long-term impact. In addition to the risks previously discussed, youth have additional risks from tobacco use, regardless of tobacco delivery form (CDC, 2022). All forms of tobacco contain nicotine (CDC, 2022). Nicotine is highly addictive and damages the adolescent’s developing brain (CDC, 2022), leading to impaired cognitive function, increased risk for mood disorders and increased predisposition for substance use abuse (Farber, Pakhale, and Neptune, 2016). E-cigarette use introduces chemicals into the body during inhalation, which can cause immediate respiratory distress and cardiovascular effects (Gordon et al., 2022). Over time, persistent exposure to the e-cigarette aerosol can cause irreversible lung damage (Gordon et al., 2022).

Youth who use tobacco products may be more likely to continue nicotine use into adulthood (CDC, 2023) and there is a strong association with youth tobacco use and depression, anxiety, and stress (CDC, 2023). Given Burke County’s limited access to behavioral health providers (Burke County, 2022), this increases the risk for Burke County youth to initiate tobacco use to cope with behavioral health

challenges (Roberts et al., 2016). Flavorings in tobacco products and targeted tobacco marketing can make them even more appealing to youth (CDC, 2023), and BCPS has identified both fruity flavorings and aggressive marketing as contributing factors to increased vaping by Burke adolescents (BCPS, 2023). All these factors combine into a compelling argument for addressing the built environment that influences tobacco usage by Burke youth.

Measures of Social Determinant of Health

In 2023, 12.6% of US high schoolers used tobacco products, primarily using e-cigarettes/vaping (CDC, 2023) (see Table C.1.3). In North Carolina, an estimated 75,900 middle and high schoolers used tobacco in 2022 (NC Youth Tobacco Survey, 2022), which translates to approximately one in every eight students (NC Youth Tobacco Survey, 2022). Within Burke County, while the county's actual prevalence of adolescent tobacco use is unknown, the 2022 Community Health Assessment revealed that over 40% of high schoolers do not believe vaping is dangerous (Burke County, 2022). In addition, Burke County high schoolers believe that the number of students being caught vaping is much lower than the actual prevalence (The Morganton News Herald, 2023), and many believe that vaping "is normal" (The Morganton News Herald, 2023).

E-cigarettes have been the most used tobacco product for all US youth since 2014 (CDC, 2023). E-cigarettes are easily concealed, do not have a smell, and are quickly and discretely utilized (CDC, 2023). As one Burke County youth described, "you can sit right in the class, and you can bend down like you're picking up a pen and hit it...the teacher will never know (The Morganton Herald, 2023)." Given the profound effect that tobacco use has on premature death and morbidity (CDC, 2023), this ease of hidden use emphasizes the need to address environmental factors impacting youth tobacco use.

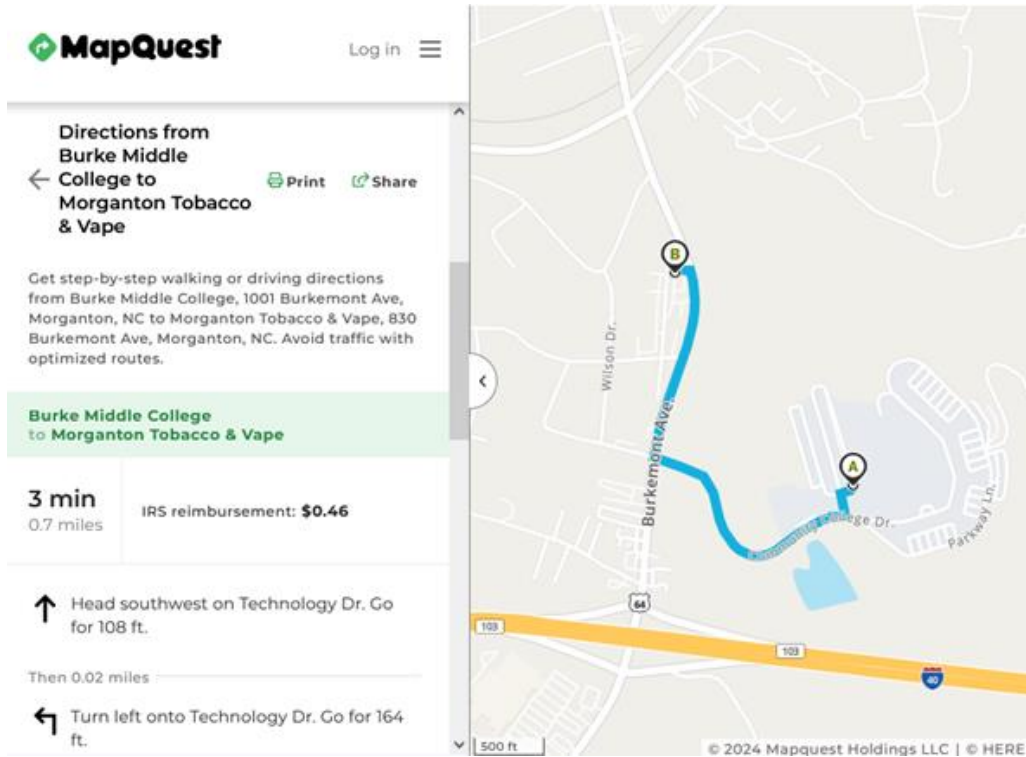
Rationale

In the US, more than 16 million people have at least one disease caused by tobacco use (CDC, 2023). This translates to more than \$170 billion in direct medical costs that could be saved annually if youth are prevented from starting to use tobacco and by helping current users quit (CDC, 2023). Burke County already faces higher adult smoking prevalence than across the state (County Health Rankings,

2024), and the built environment contains elements that increase accessibility and acceptability of youth tobacco use. Multidisciplinary efforts must be coordinated to focus resources and community planning to minimize youth tobacco initiation and usage through modification of the built environment. The youth in Burke County must be supported with additional policy, programming, and resources to maximize their health and wellness if Burke County is to have future generations to enjoy it.

Appendix C.1.a: SDOH Individual Tables and Figures

Figure C.1.1: Map of Distance between Burke Middle College High School and Morganton Tobacco & Vape



Map from Mapquest. (2024). *Directions from Burke Middle College to Morganton Tobacco & Vape.*
<https://www.mapquest.com/directions/list/1/from/us/north-carolina/burke-middle-college-418394430/to/us/north-carolina/morganton-tobacco-vape-374094980>

Table C.1.1: Demographics of Burke County, North Carolina from US 2020 Census

Total Population, Census, 2020	87,570
Percent Female Persons	49.8%
Percent Persons Under 18 Years	17.8%
Percent Persons Under 5 years	4.6%
RACE/ETHNICITY	
White alone, percent	85.9%
Black alone, percent	6.5%
American Indian or Alaska Native alone, percent	1.0%
Asian alone, percent	3.8%
Native Hawaiian and other Pacific Islanders alone, percent	0.7%
Two or more Races, percent	2.0%
Hispanic or Latino, percent	7.0%

Data Source: United States Census Bureau, 2023,
<https://www.census.gov/quickfacts/burkecountynorthcarolina>

Table C.1.2: Table of Select Health Outcomes for Burke County in Comparison to North Carolina and the United States

Health Outcome	Burke County	North Carolina	United States
Adult Smoking	23%	17%	16%
Access to Exercise Opportunities	60%	75%	84%
Food Insecurity	16%	12%	12%
Children in Poverty	20%	18%	17%
Broadband Access	77%	85%	87%

Data Source: County Health Rankings, 2024, <https://www.countyhealthrankings.org/explore-health-rankings/north-carolina/burke?year=2023>

Table C.1.3: Table of Current Tobacco Use Among United States High School Students in 2023

Tobacco Product	Overall	Girls	Boys
Any tobacco product	12.6%	14.1%	11.2%
Electronic cigarettes	10.0%	12.2%	8.0%
Cigarettes	1.9%	1.5%	2.3%
Cigars	1.8%	1.4%	2.3%
Smokeless tobacco	1.5%	—	2.1%
Hookah	1.1%	1.4%	0.9%
Nicotine Pouches	1.7%	—	2.6%
Heated tobacco products	1.0%	0.7%	1.4%
Pipe tobacco	0.6%	0.5%	0.7%

Data source: CDC, 2023, Youth & Tobacco Use,
https://www.cdc.gov/tobacco/data_statistics/fact_sheets/youth_data/tobacco_use/index.htm

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Appendix C.2: Alignment and Vision

Background

The neighborhoods in which people live have profound impact on health, with a wide range of factors that local, state, and federal policy and programming can influence (Centers for Disease Control and Prevention (CDC), 2022). The environment creates structures and spaces that inform the lived experience, such as having highways cut through neighborhoods without crosswalks versus having sidewalks and bike lanes on the roads for increased opportunity to walk and bike (Healthy People 2030, n.d.). Within the social determinant of Neighborhood and Built Environment, County Health Rankings measures tobacco use, both through exposure to second-hand smoke (SHS) as well as direct tobacco use (County Health Rankings, 2022). Tobacco use and SHS remain leading causes of preventable disease, morbidity, and mortality in the United States (US) (Buettner-Schmidt, Miller & Maack, 2019). Tobacco use harms almost every organ in the body (CDC, 2022), with tobacco use causing cancer, heart disease, stroke, lung disease, diabetes, and other chronic illness (CDC, 2022). Individuals who do not use tobacco directly but are exposed to SHS have increased risk of stroke, lung cancer, and heart disease (CDC, 2022).

In 2023, 12.6% of US high schoolers used tobacco products, primarily using tobacco via the form of e-cigarettes/vaping (CDC, 2022). In addition to the risks previously listed, youth have additional risks from tobacco use, regardless of tobacco delivery form (CDC, 2022). All forms of tobacco contain nicotine (CDC, 2022). Nicotine is highly addictive and damages the adolescent's developing brain (CDC, 2022), leading to impaired cognitive function, increased risk for mood disorders and increased predisposition for substance use abuse (Farber, Pakhale, and Neptune, 2016). E-cigarette use introduces chemicals into the body during inhalation, which can cause immediate respiratory distress and cardiovascular effects (Gordon et al., 2022). Over time, persistent exposure to the e-cigarette aerosol can cause irreversible lung damage (Gordon et al., 2022). Despite vaping being unsafe for adolescents (CDC, 2023), within Burke County, over 40% of high schoolers do not believe vaping is dangerous (Burke County, 2022). In addition, Burke County high schoolers believe that the number of students being caught vaping is much

lower than the actual prevalence (The Morganton News Herald, 2023), and many believe that vaping “is normal (The Morganton News Herald, 2023)”.

Burke County must address the built environment and neighborhood conditions that make it more or less likely for youth to engage in tobacco use. Burke County School District has seen an increase in vaping of students over recent years (Burke County School District, 2023), citing built environmental factors such as marketing fruity flavors of vape cartridges towards young people (Burke County School District, 2023) as contributing variables to this increase.

Leadership and Accountability Partnership

To promote a tobacco- and vape-free Burke County School District, a collaboration of various stakeholders will be convened to drive this change effort. While a larger committee will ideally be mobilized, a core group of members will form a steering committee. The steering committee members will serve as project champions in each of their respective spheres of influence.

The steering committee will include at least one school administration member of the Burke County Public Schools’ School Health Advisory Board (SHAC), which is an established working partnership that aims to align efforts with school administration, parents, and students (Burke County Public Schools, n.d.). The presence of school administration on the steering committee will support continuity in implementation across years at the school level, in addition to bringing knowledge of the school system and school district policy.

Committee representation will include students, ideally two or three youth to accommodate for limited availabilities that youth can have with other extracurricular activities. Student voice will be key to identifying methods and programming that resonates with youth, as well as illuminating relevant challenges with respect to tobacco and vaping use pressure (Miller et al., 2023). For example, student voices may provide insight into the impact on their daily experience of having vaping shops within walking distance to the school grounds. Parent voice will also be present on the steering committee, as they desire to improve conditions for their children. Parents can provide unique perspective into

additional factors in the built environment (The Community Tool Box, 2023a) that influence tobacco and vape use.

Steering committee membership will include Burke Recovery's Adolescent Preventative Services. As this program currently works in Burke Schools providing education on tobacco usage, along with other substance use, programming and resources are already established (Burke Recovery, 2024). Thus, Burke Recovery staff also have a distinct perspective of what in the built environment makes it more or less likely for Burke youth to use tobacco and vape products.

Burke County Public Health Department will also be included on the steering committee. This will allow the project to leverage health department resources and accelerate community partnerships (Burke County, n.d.-a). It will also enable alignment with existing health department programming, such as the adult Tobacco Cessation program (Burke County, n.d.-a).

The committee will seek input from Burke vape shop owners. As of February 2024, there are at least eight distinct tobacco/vape shops within the county seat of Morganton, NC (Chamber of Commerce, 2024). Small tobacco shop business owners are in unique positions to stay profitable while also supporting the wellness of their community (Farber, Pakhale, and Neptune, 2016). This voice may offer opinions that differ from the rest of the committee, making it a key perspective to include (Yukl, 2013). If the shop owner is unable to commit to the steering committee, this stakeholder will remain informed and be consulted throughout the project.

Additionally, representation on the steering committee will include a member of Burke County's Community Development department, which is responsible for zoning ordinances and planning (Burke County, n.d.-b). Zoning is a critical component of the built environment, for both current and future community planning (The Community Tool Box, 2023a).

Governing Vision and Goals

The steering committee and the entire project will be guided by a shared vision. This vision is that Burke County youth enjoy tobacco- and vape-free lives, enabled by an environment that promotes their health and wellbeing. Moving forward with this project will allow examination of components of Burke

County's built environment that contribute to this vision. For example, analysis of distance between vape shops and school grounds may reveal a physical spacing pattern of proximity, increasing the likelihood of youth walking next to the shop (Farber, Pakhale, and Neptune, 2016). This could be modified through zoning ordinance changes requiring at least a minimum distance between them (Farber, Pakhale, and Neptune, 2016). By conducting detailed stakeholder analyses, themes might emerge pointing to a need for additional school policy to implement school-based behavioral health support options (Miller et al., 2023), instead of students coping with stress via tobacco and vape usage (CDC, 2023). The insights of the community may reveal that tobacco usage is viewed as normal among adults as well as youth, and the committee may opt to modify zoning ordinances to restrict tobacco marketing in shop windows to decrease the perceived acceptability of tobacco usage (Farber, Pakhale, and Neptune, 2016).

The potential methods to achieve this vision are varying, and will be largely impacted by the lived experiences and shared perspectives of the stakeholders that convene. However, goals will be set in the initial phase of this project to help move towards this vision.

Goal #1: Steering committee membership will include at least five different types of member representation for at least 80% of the meetings for one year. Different member characteristics might include student, parent, principal, health department employee, tobacco shop owner, zoning officer, Burke Recovery staff member, pediatric provider, or behavioral health provider. Leadership will need to focus on community participation as a core component of the program's success (The Community Tool Box, 2023a). Especially if one group views certain aspects, such as proximity of vape shops to schools, as insignificant while another group views it as influential, the committee must work to bring all stakeholders together through asking questions and remaining curious (Yukl, 2013). This innovative space will likely create even more creative solutions than those already considered (Yukl, 2013) to address the challenges currently facing Burke students. Collaborating with diverse stakeholders to implement this program will provide opportunities for adaptive change (Yukl, 2013) in Burke schools and the county. Thus, tracking membership characteristics is one method to measure success of the project.

Goal #2: Increase the number of active committee members by 20% over the first year of the program. As previously mentioned, dedicated individuals already work at Burke Recovery's Adolescent Preventative Services (Burke Recovery, 2024). However, by expanding this project into a community-wide change effort, it can increase awareness as well as enhance sustainability over time (The Community Tool Box, 2023a). By gaining buy-in from additional stakeholders, such as potentially improved understanding of the youth-specific risks for tobacco and vape product use, local tobacco shop owners may be more willing to enforce age requirements when selling products or limit the availability of fruity flavor vape cartridges (Farber, Pakhale, and Neptune, 2016). Increasing community awareness can also initiate conversations in community planning, which can have long-term impacts (The Community Tool Box, 2023b). Having increased membership might result, for example, in a current committee member that becomes a future city councilperson voting against zoning permits for another tobacco shop. Potential impact of having increased membership is expansive, and can increase reach across Burke County in a variety of spheres.

Goal #3: Youth representatives will lead at least 25% of the program meetings, including agenda setting and invitee list. This leadership can happen in a co-facilitated manner, developing youth leadership skills and allowing their perspective to inform the project's decisions (Miller et al., 2023). Youth advocates have been shown to be highly effective in Appalachian tobacco-control programs, with increased self-efficacy, interpersonal skills, and self-advocacy after being supported as youth advocates (Miller et al., 2023). Burke County youth have expressed that tobacco and vaping is an issue that matters to them (The Morganton News Herald, 2023), yet youth advocacy has yet to be implemented formally in Burke schools (Burke County, 2022). By utilizing this goal as a measure of success, the committee is advancing the vision, as well as supporting youth with opportunity to develop and grow their own leadership (Miller et al., 2023). Additionally, youth advocates can work with peers in ways adult counseling cannot replicate (Miller et al., 2023), as well as identify specific aspects of the built environment that increase the likelihood of tobacco and vaping use (The Community Tool Box, 2023b).

To further promote shared accountability, the committee will utilize a RASCI analysis for each of the three main goals (see Appendix C.2.1 for complete analysis). This identification of who is

Responsible, Accountable, Supportive, Consulted, and Informed (RASCI) will improve accountability as well as increase the likelihood that the results obtained are intentional (Wandersman et al., 2000).

Appendix C.2.a.: Alignment and Vision Individual Tables and Figures

Table C.2.1: RASCI Analysis of Project Goals

RASCI Levels	Project Goals		
Who is...	Goal 1- Steering committee membership will include at least five different types of member representation for at least 80% of the meetings for one year.	Goal 2- Increase the number of active* committee members by 20% over the first year of the program. *Active defined as participating in at least 70% of meetings and/or functions.	Goal 3 - Youth representatives will lead at least 25% of the program meetings, including agenda setting and invitee list.
Responsible	<ul style="list-style-type: none"> ● Student Health Advisory Council (SHAC) ● Burke Recovery 	<ul style="list-style-type: none"> ● SHAC ● Burke Recovery 	<ul style="list-style-type: none"> ● SHAC ● Parents
Accountable	<ul style="list-style-type: none"> ● SHAC ● Health Department ● School District 	<ul style="list-style-type: none"> ● SHAC ● Health Department ● School District 	<ul style="list-style-type: none"> ● SHAC ● Health Department ● Parents ● Students
Supportive	<ul style="list-style-type: none"> ● Parents ● Students ● Pediatricians and Health Care Providers 	<ul style="list-style-type: none"> ● Parents ● Students ● Health Department 	<ul style="list-style-type: none"> ● School Staff ● Parents
Consulted	<ul style="list-style-type: none"> ● Vape shop owners ● Zoning officer ● School Nurse ● Tobacco industry marketing (focusing on local staff who display tobacco marketing in tobacco shops) 	<ul style="list-style-type: none"> ● Local faith-based organization leaders ● Adult Participants of Burke County’s Tobacco Cessation program 	<ul style="list-style-type: none"> ● School Administration ● Members of school government
Informed	<ul style="list-style-type: none"> ● Parents ● Students ● School District 	<ul style="list-style-type: none"> ● Parents ● Wider program committee 	<ul style="list-style-type: none"> ● Parents ● School District ● Wider program committee

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<https://www.chamberofcommerce.com/business-directory/north-carolina/morganton/shopping/tobacco-shop/?what=Tobacco+Shop&where=undefined>
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Appendix C.3: Co-Design Approach

Social Determinant of Health

The social determinant of health category “Neighborhood and Built Environment” centers on how the neighborhoods and environments where people live significantly influence their health and well-being (Healthy People, 2030). The specifics of the built environment either encourage or discourage people to engage with behaviors such as tobacco use (Healthy People, 2030). The built environment encompassing e-cigarette use in Burke County is a contributing factor to the high prevalence of adolescent usage. The proximity of tobacco shops with the five middle schools and four high schools of Burke County Public Schools is notable, such as a 0.7mile walkable distance from Burke Middle College High School to Morganton Tobacco and Vape (Mapquest, 2024) (see Figure C.3.1 for detailed map). Tobacco use causes increased poor health outcomes (Healthy People, 2030), including cancer, heart disease, stroke, lung disease, diabetes, and other chronic illness (Centers for Disease Control and Prevention [CDC], 2022).

Tobacco usage in North Carolina is higher than the average in the United States (Burke County Health Department [BCHD], 2022). Tobacco usage in Burke County, NC is higher than the state average (BCHD, 2022). Adolescent (ages 10-19) tobacco use has been a rising problem in Burke County with e-cigarettes/vaping being the most prevalent form of tobacco use among this population (North Carolina Department of Health and Human Services [NCDHHS], 2023). The nicotine in the tobacco is highly addictive and damages the adolescent’s developing brain (CDC, 2022), leading to impaired cognitive function, increased risk for mood disorders and increased predisposition for substance use abuse (Farber, Pakhale, and Neptune, 2016). E-cigarette inhalation causes immediate respiratory distress and cardiovascular effects (Gordon et al., 2022), and long-term exposure can cause irreversible lung damage (Gordon et al., 2022).

As vaping flavors targeted toward younger audiences gained popularity, schools in the Burke County Public Schools (BCPS) witnessed a rise in the use of e-cigarettes (BCPS, 2023). Thus, BCPS implemented a no-vaping policy on school buildings, school grounds, buses, and during school-sponsored

activities off-campus (BCPS, 2023). Policy can serve as an effective modifier to the built environment (The Community Tool Box, 2023). However, despite the new BCPS policy, over 40% of high schoolers within Burke County do not believe vaping is dangerous (Burke County, 2022). In addition, Burke County high schoolers believe that the number of students being caught vaping is much lower than the actual prevalence (The Morganton News Herald, 2023), and many believe that vaping “is normal” (The Morganton News Herald, 2023).

Co-Design Scope and Objectives

To address this challenge, the commissioners will need to leverage community partners for effective and sustainable impact (The Community Tool Box, 2023). This team of community partners will become the co-design team. Co-design is a valuable approach to understand and incorporate the diverse perspectives of community partners to find effective solutions for challenges in the built environment (Hatton et al., 2020).

Inclusion on the co-design team of a teenager who currently vapes or previously vaped will ensure identified action steps resonate for the youth of Burke County, as youth and adults will have different experiences with this topic. Youth voice is key to ensuring the lived experience of Burke adolescents are centered in the action steps of the transformation (Miller et al., 2023). Another important co-design team member is a parent of a Burke teenager. It may be a parent who smokes cigarettes themselves, thus bringing perspective of how Burke County norms may be influencing youth’s experience surrounding tobacco products, availability, and their acceptability (Miller et al., 2023).

As Burke Recovery Adolescent Preventive Services already works in the schools, a staff member from this program will be a key community partner and member of the co-design team. This will help utilize existing programming, infrastructure, and relationships with the youth as the project expands beyond Burke Recovery’s current reach (BCPS, 2023).

A member of the Student Health Advisory Council (SHAC) will be another important co-design team member. The administration of the school district has unique insight and leverage into school policies, as well as potential influence on other local government officials such as zoning officers (BCPS,

n.d.). This influence will be especially helpful if the project moves forward with policy and/or zoning changes.

Representation of the Burke County Public Health Department on the team is also important as a key community partner. This will allow the project to leverage health department resources and accelerate community partnerships (Burke County, n.d.). It will also enable alignment with existing health department programming, such as the adult Tobacco Cessation program (Burke County, n.d.).

This project will be guided by the principles of design justice. This includes centering the voices of those directly impacted and working towards sustainable, community-led outcomes (Design Justice Network, 2018). It will be grounded in a collaborative design process that focuses on users, seeking innovative solutions through an iterative and emergent process (Design Justice Network, 2018). Given that the built environment of Burke County is sustained or modified by the local community, focusing on community-led solutions is the most effective method to increase sustainability (The Community Tool Box, 2023).

The design approach will involve co-design principles, where everyday people are participating in the design process (Sanders & Stappers, 2008). Co-design is important in complex systems (Sanders & Stappers, 2008), and the system to reduce e-cigarette adolescent use through modification of the built environment in Burke County is extremely complex and wicked as discussed in the previous Systems paper and its associated Causal Loop Diagram (CLD) (see Appendix C.3.2 for diagram). The design approach will primarily involve participatory design elements, such as centering the user's experience and teaching participants how to use the design tools (Sanders & Stappers, 2008). The design approach will also blend elements of community-based participatory research, including the intentional goals to increase partnership among users and create sustainable solutions that are relevant and address user needs (Detroit Urban Research Center, 2021). As the CLD identified, existing information flows and community norms are contributing to the built environment that normalizes tobacco use with high accessibility for adolescents (Hatton et al., 2020). Addressing information flows through participatory design will support the modification of the local context to modify aspects of the built environment (The Community Tool

Box, 2023), such as proximity of vape shops to schools and/or public-facing marketing of fruity-flavored vape cartridges.

Personas, User Stories, Needs and Quality Characteristics

In the county, 42.7% of Burke residents live in a rural area, with 500 or fewer people per square mile (County Health Rankings, 2024), and many people fill various roles simultaneously such as staff at the Health Department, being a parent of a teenager, and volunteering for the school district (BCHD, 2022). This overlap of roles is well-suited to using co-design principles where each member of the co-design team is viewed as both consumer and designer (Sanders & Stappers, 2008). In this way, each member of the design team is valued for the lived experience they bring, working together in close collaboration to solve the complex challenge (Sanders & Stappers, 2008) of Burke County's built environment in relation to tobacco usage.

Stakeholder interviews and other qualitative research can culminate in personas, which serve as rich composites of stakeholders to support the design process and ideation (Hatton et al., 2020). Personas are effective design tools specific to modification of the built environment (Hatton et al., 2020). Two personas for this project are Bethany - The Teenager Who Vapes, and Adam - The Adult Who Works at Burke Recovery (see Figures C.3.3 and C.3.4 for detailed information on each persona). Personas can then be represented on an empathy map, which can serve to better understand the context and inner motivations within the given system (Hatton et al., 2020) (see Figure C.3.5 for Adam's empathy map). As this project aims to modify the built environment, deep understanding of each user's engagement with the system is needed to effectively utilize leverage points specific to the built environment (The Community Tool Box, 2023).

Using these design tools, user stories arise which can be translated into user needs. The user needs can be plotted on a Kano model, which is a visualization to assist prioritization of user needs and place each into categories of basic, performance, or delighter (see Tables C.3.1, Table C.3.2, Figure C.3.6 for detailed information on persona user stories, needs and prioritization). User needs for Bethany include: tools and skills to cope with stress and manage anxiety in healthy ways; education about impact

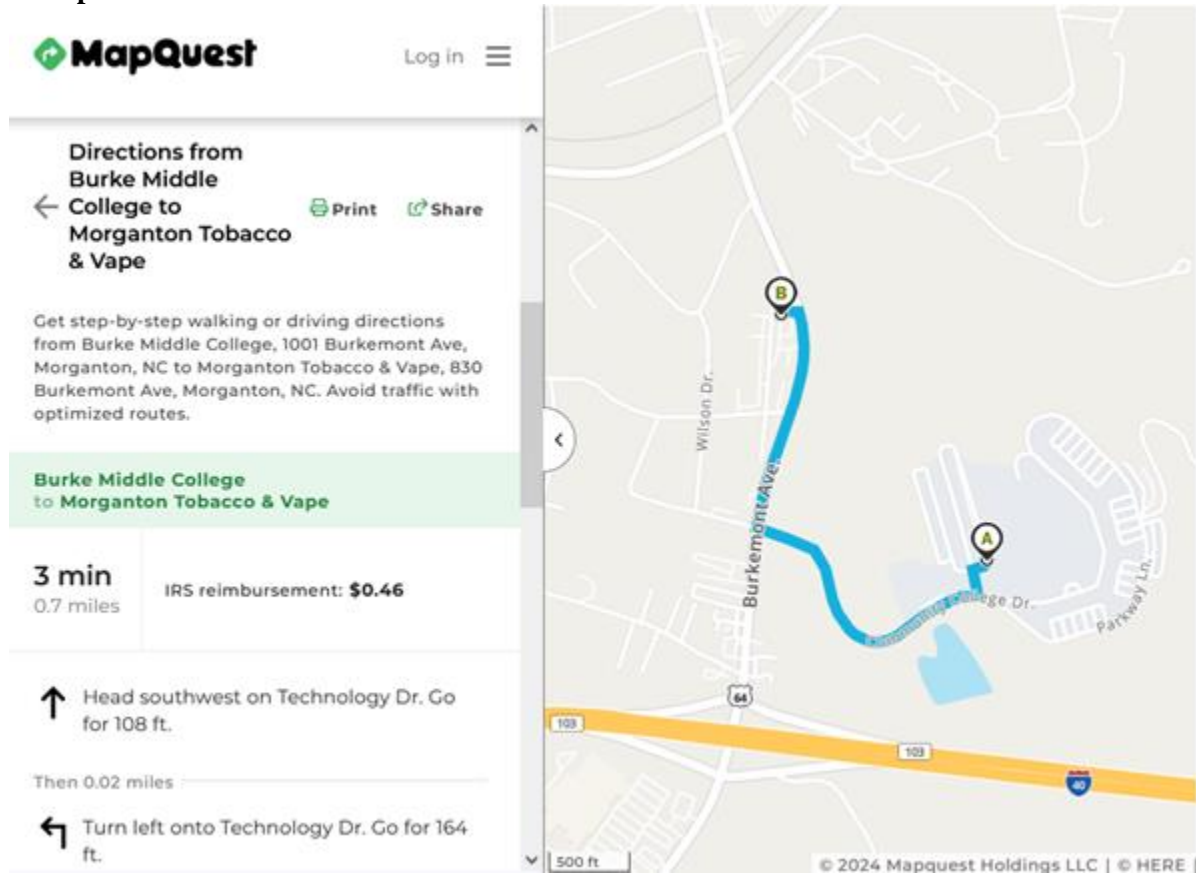
of vaping on the body and brain including risk of addiction; and safe places to walk with friends for social and mental well-being. Adam has his own set of user needs: environment and cultural norms that reduce acceptability and accessibility of vaping; educational programs and school policy that support healthy choices; and staff that finds meaning and purpose in the job they perform.

User needs are translated into quality characteristics, which are features that the program must include to ensure it is meeting the user needs (Hatton et al., 2020). Quality characteristics serve as guiding metrics to determine if the system transformation is effective as designed (Hatton et al., 2020). Through the co-design process, additional community partners will be analyzed to diversify the understanding of the context of tobacco usage in the built environment. This will lead to varying user needs and associated quality characteristics. Using the analysis from the personas of Bethany and Adam (see Tables C.3.1 and C.3.2), critical quality characteristics include: student self-reported level of ability to cope with stress (self-efficacy); annual percentage of BCPS students who have received comprehensive education about vaping; and percentage of BCPS schools with walkable routes around campus that have no tobacco sales occurring within one mile radius.

These characteristics inform the design brief, which functions as a concise and objective description of the output from the design work while also allowing for specific solutions to emerge later in the iterative design process. The design brief for this project is as follows: The project will seek to ensure that all BCPS students are educated about the risks of vaping and empowered with tools to healthfully cope with stress, while modifying additional aspects of the Burke County built environment including tobacco sales surrounding BCPS campuses, to reduce the accessibility and acceptability of adolescent tobacco usage.

Appendix C.3.a: Co-design Approach Individual Tables and Figures

Figure C.3.1: Map of Distance between Burke Middle College High School and Morganton Tobacco & Vape



Map from Mapquest. (2024). *Directions from Burke Middle College to Morganton Tobacco & Vape.* <https://www.mapquest.com/directions/list/1/from/us/north-carolina/burke-middle-college-418394430/to/us/north-carolina/morganton-tobacco-vape-374094980>

Figure C.3.2: Causal Loop Diagram from Systems Deliverable 1 by Ashley Pyo

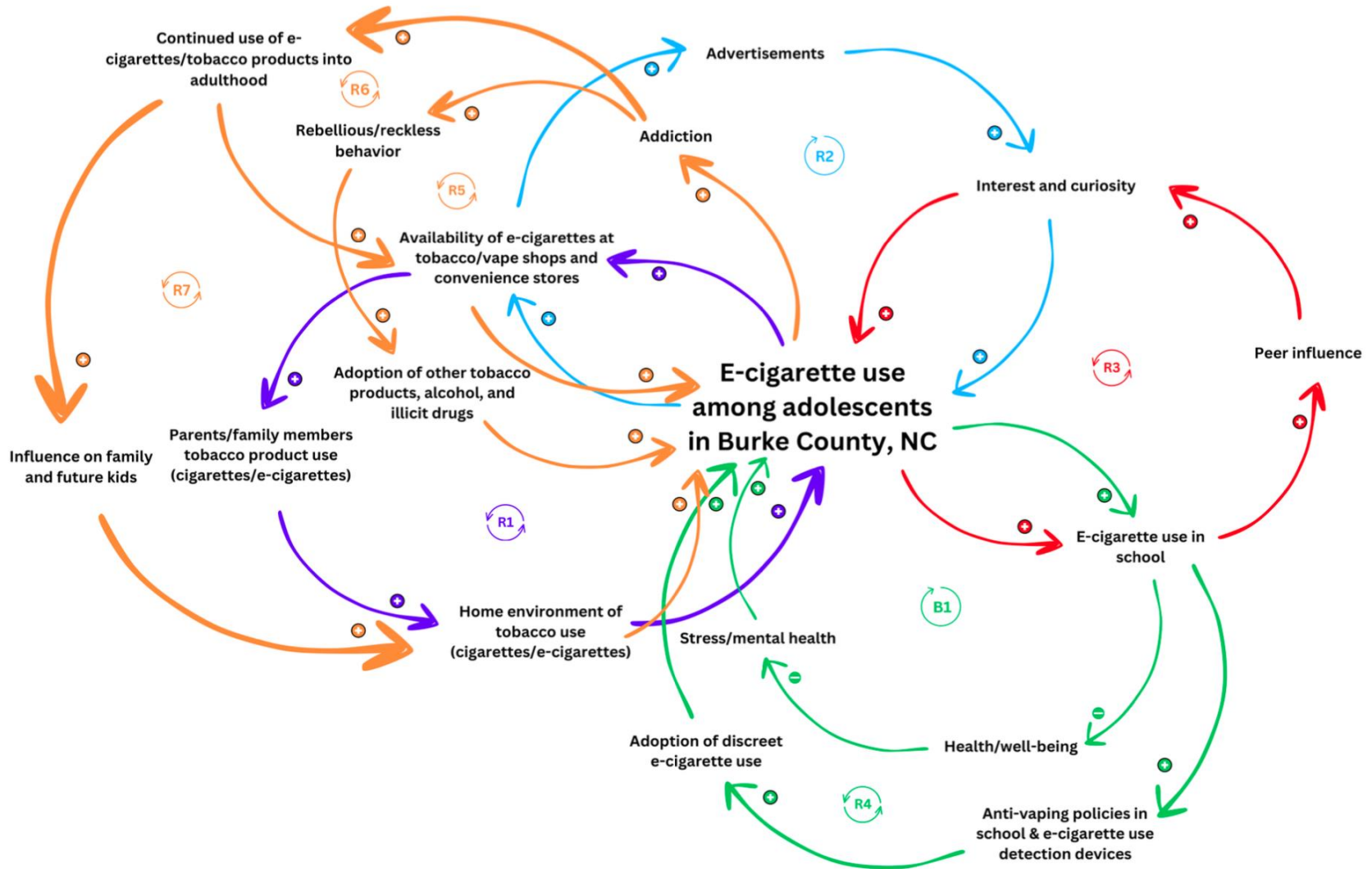


Figure C.3.3: Persona of Teenager Who Vapes



Bethany

Age: 16

I'm an 11th grader at Burke Middle College High School in Morganton. I really want to go to Western Piedmont Community College here in Morganton for Criminal Justice Technology, but I'm worried my grades aren't good enough.

I started vaping when I was 14 when a friend suggested it might help take the edge off my stress. I'm not sure it helped my stress, but now I can't really stop.

Me and my friends walk to Morganton Tobacco Vape after school to purchase vape pens a couple times a week. The Fruity Pebbles flavor is the best. I know it's not allowed at school, but it's easy to hide because it looks like a highlighter. My parents smoke cigarettes, which is so disgusting and smells gross, plus its bad for their health. But vaping isn't really any big deal, I don't know what all the fuss is about.

Image from https://media.sciencephoto.com/image/f0012249/800wm/F0012249-Teenage_girl.jpg

Figure C.3.4: Persona of Adult Who Works at Burke Recovery



Adam

Age: 38

I work for Burke Recovery in Adolescent Preventative Services. I've lived here in Burke my whole life, and I love this community.

I used to smoke cigarettes, but I quit after both my parents got cancer after smoking their whole lives. I understand how hard it is to quit, which is why I started this job working in the schools with the kids. I get to do educational programs for the community, as well as individual support after kids get caught vaping.

I really wish the teens knew how bad vaping is for them, and how hard it is to break the addiction once started. It's just so hard because tobacco use is everywhere in Burke, and it is so easy for these kids to buy it and use it.

Image from <https://www.shutterstock.com/image-photo/hes-confident-successful-businessman-260nw-563813287.jpg>

Figure C.3.5: Empathy Map for Persona of Adam

EMPATHY MAP for Adam

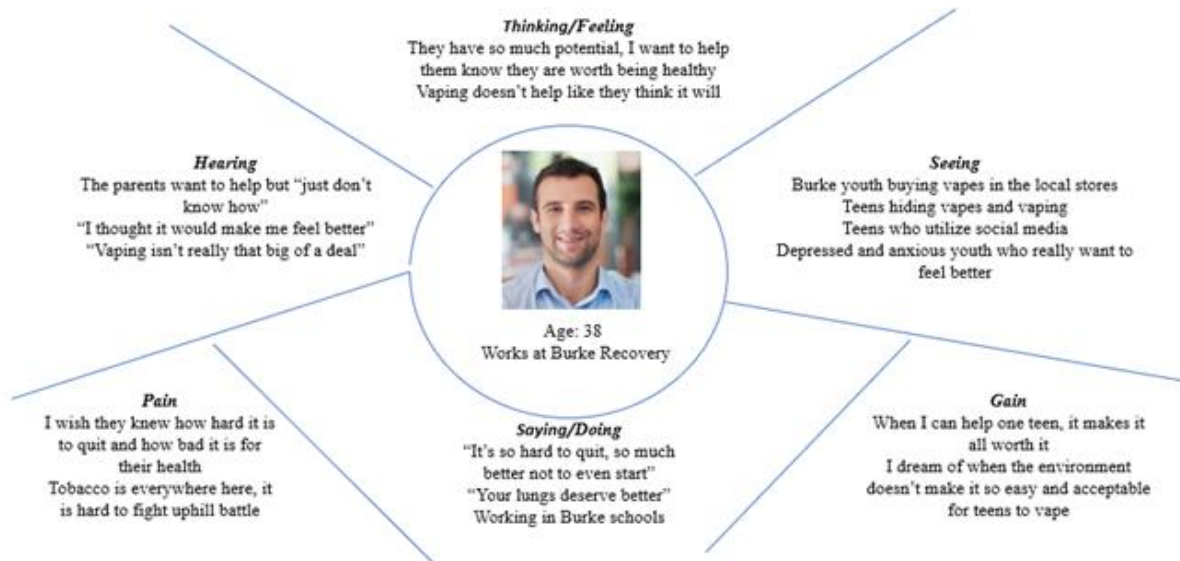


Image from <https://www.shutterstock.com/image-photo/hes-confident-successful-businessman-260nw-563813287.jpg>

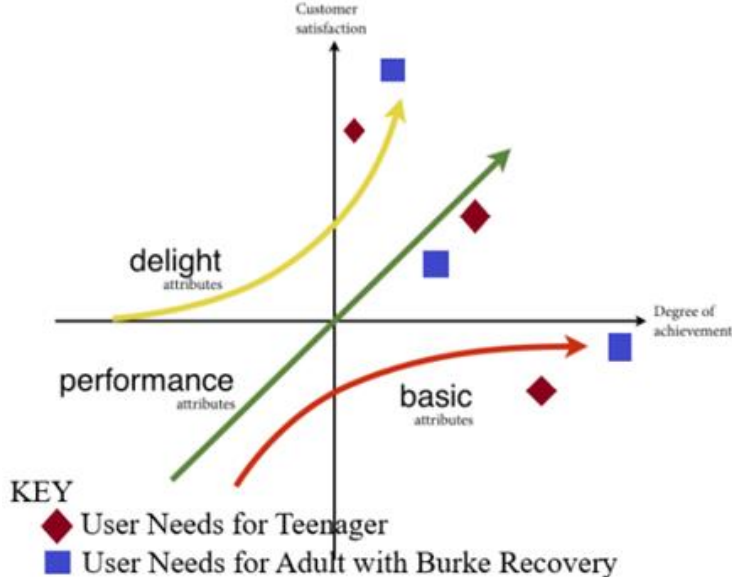
Table C.3.1: Table of User Stories, Needs and Quality Characteristics for Teenager

User Story	User Need	Need Category	Quality Characteristic
As a teenager, I want to be less stressed and anxious about my grades and my future so that I can enjoy life now.	Tools and skills to cope with stress and manage anxiety in healthy ways	Performance	Self-reported level of ability to cope with stress (self-efficacy)
As a teenager, I want to understand what the fuss is about vaping so that I can be healthy.	Education about impact of vaping on the body and brain, risk of addiction	Basic	Annual percentage of BCPS students who have received comprehensive education about vaping
As a teenager, I want to walk in the neighborhood with my friends so that I can have good friendships and be happy.	Safe places to walk with friends for social and mental well-being	Delighter	Percentage of BCPS schools with walkable routes around campus that have no tobacco sales occurring within one mile radius

Table C.3.2: Table of User Stories, Needs and Quality Characteristics for Adult Working at Burke Recovery

User Story	User Need	Need Category	Quality Characteristic
As an adult who works for Burke Recovery, I want the adolescents to not be so pressured to vape by others or the environment so that they vape less.	Environment and cultural norms that reduce acceptability and accessibility of vaping	Performance	Percentage of BCPS with surrounding areas free of tobacco sales
As an adult who works for Burke Recovery, I want to educate and support the youth to make good decisions so that they can be healthy.	Educational programs and school policy that support healthy choices	Basic	Number of school programs offered to all BCPS students on vaping
As an adult who works for Burke Recovery, I want to make positive impact in this community and support the youth to live full lives so that I can enjoy my work.	Staff finds meaning and purpose in the job they perform	Delighter	Percentage of staff self-reporting positive job satisfaction

Figure C.3.6: Kano Model of User Needs



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APPENDIX D: ASHLEY PYO'S INDIVIDUAL DELIVERABLES

Appendix D.1: Social Determinants of Health Analysis

Social Determinant of Health (SDOH)

The social determinant of health (SDOH) centered on the neighborhood and built environment underscores the significant influence of physical surroundings on an individual's health and well-being (OASH, n.d.). Tobacco use and exposure to secondhand smoke stand out as notable contributors to heightened health risks within this context (OASH, n.d.). North Carolina's smoking rates surpass the national average, with Burke County exhibiting even higher prevalence rates (BCHD, 2022). Particularly alarming is the prevalence of smoking among adolescents aged 10 to 19, with e-cigarettes emerging as the primary choice within this demographic (NCDHHS, 2022). Despite the implementation of strict no-vaping policies in Burke County Public Schools, adolescent e-cigarette use persists, fueled by the widespread availability of e-cigarettes and compelling marketing tactics (BCPS, 2023). For instance, within Burke County Public Schools, there are five middle schools and four high schools, each surrounded by six smoke shops. This underscores the multifaceted challenge of reducing access and exposure to e-cigarettes.

In the immediate context, adolescents engaging in e-cigarette use are subjected to acute respiratory and cardiovascular effects (Gordon et. al., 2022). The inhalation of substances present in e-cigarettes, such as nicotine and other harmful chemicals, can lead to respiratory distress, exacerbation of pre-existing respiratory conditions, and an increased heart rate (Gordon et. al., 2022). These short-term consequences underscore the urgency of addressing this SDOH, as they directly impact the day-to-day health and well-being of adolescents.

The long-term repercussions of adolescent e-cigarette use are equally concerning. Nicotine can lead to the development of a lasting addiction (Huizink, 2022). Furthermore, the continuous exposure to e-cigarette aerosol may compromise lung function over time, leading to chronic respiratory issues (Huizink, 2022). Adolescents who use e-cigarettes may also face an elevated risk

of transitioning to traditional tobacco products, compounding the health risks associated with combustible tobacco use (Gordon et al., 2022; Huizink, 2022). Additionally, studies indicate a potential correlation between e-cigarette use and diminished academic performance, possibly stemming from decreased attention and memory capabilities following repeated exposure to nicotine (Mooney-Leber & Gould, 2018). These long-term health consequences extend well into adulthood, emphasizing the need for early intervention to mitigate the potential lifelong impact on health outcomes.

Geographic and Historical Context

Burke County, NC, nestled in the Mountain region, has a diverse history shaped not only by Catawba and Cherokee Indians but also by its historical association with tobacco, which was once a prominent cash crop in the region (Bangma, 2006). The cultivation and sale of tobacco played a significant role in shaping the county's economy and culture, with many families relying on it as a primary source of income. Over time, however, as the tobacco industry faced challenges and changes, Burke County's economy transitioned from being primarily dependent on tobacco to diversifying into other industries such as furniture, chemicals, machine parts, and agriculture (Bangma, 2006). Despite the decline of tobacco as a dominant economic force, its legacy still lingers in the county's history and landscape.

Despite its positive aspects, Burke County grapples with ongoing challenges. Notably, 42% of its population was recorded below 200% of the Federal Poverty Level in between 2017 and 2020, and in 2019, 13.7% of residents encountered Housing and Urban Development (HUD)-designated housing problems (CHA, 2023; Health Community NC, 2023). Additionally, health concerns include drug poisoning deaths at a rate of 31.3 per 100,000 between 2012 and 2019, with smoking rates standing at approximately 23% in 2022 (CHA, 2023; Health Community NC, 2023). Moreover, the healthcare landscape, anchored by UNC Health System Blue Ridge, is significant, yet difficulties persist, with 8.6% lacking health insurance in 2020 (CHA, 2023).

Collaborative initiatives such as the initiation of the Virtual Care Unit during the COVID-19 pandemic, have the potential to enhance health outcomes. However, despite commendable progress, Burke County faces challenges, and among them is North Carolina's status as one of the 12 states that have not adopted Medicaid coverage expansion (CHA, 2023). This stance exacerbates difficulties in accessing crucial healthcare services. The multifaceted nature of these challenges emphasizes the imperative for ongoing collaboration and focused interventions to address the intricate health and socioeconomic landscape of the county.

Priority Population

The targeted population for the SDOH issue in Burke County are adolescents. The implementation of an anti-vaping policy by Burke County Public Schools underscores the growing concern about the rising trend of e-cigarette usage among young individuals. This policy, effective as of August 28, 2023, imposes stringent consequences, including vape confiscation, enrollment in a cessation program, and varying suspension periods for offenses. Wendi Craven, Chairwoman of the Board of Education, emphasizes the need to deter unhealthy activities, positioning the policy as a unique stand-alone initiative in the state (Burke County Public Schools, 2023).

Despite the policy, challenges persist, with 353 recorded instances of students facing disciplinary actions for vaping during the ongoing academic year. However, stakeholders believe this number may underestimate the actual prevalence, emphasizing the difficulty of detection due to discreet vaping methods and disguised devices. Adolescent Prevention Service Program Coordinator for Burke Recovery, Matikia Robinson, highlights the presence of vaping, reaching even elementary school students (Koon, 2023).

Efforts to combat vaping extend beyond punitive measures. Burke County Public Schools plans to pilot a vape-detector program using Zeptive at selected schools (Koon, 2023). This program aims to enhance detection through real-time alerts and is part of broader strategies, including education and intervention (Koon, 2023). The curriculum covers the health consequences of vaping, emphasizing

addiction and the harmful chemicals present in vape pods (Koon, 2023). Education coordinator, Renaye Chapman, stresses the need to inform students about the risks, including addiction and potential allergic reactions (Walker, 2023).

Measures of SDOH

The North Carolina Youth Tobacco Survey (NC YTS) provides crucial insights into the occurrence of e-cigarette use among youth in the state. In 2019, 20.9% of high schoolers and 6.1% of middle schoolers reported e-cigarette use (see Figure D.1.1). The prevalence of e-cig use has seen alarming increases, with a 510% rise among middle schoolers and a staggering 1129% surge among high schoolers from 2011 to 2019 (NCDHHS, 2019).

Examining disparities, the 2019 data reveals variations by race and ethnicity, with 25.8% of white students, 12.8% of Black or African American students, 17% of Hispanic or Latinx students, and 20.3% identifying as others reporting high school e-cigarette use (see Figure D.1.2). Notably, tobacco use, including e-cigs, was higher among lesbian, gay, and bisexual (LGB) students compared to non-LGB students (see Figure D.1.3) [NCDHHS, 2019].

The 2022 NC YTS highlights persistent concerns, indicating that 1 in 8 high school students currently uses a tobacco product, equivalent to about 3 students in every classroom. Alarmingly, it is estimated that 43,800 high school students and 12,500 middle school students used e-cigarettes (see Figure D.1.4) with disposable e-cigarettes as the most common type of tobacco product used by youth (see Figure D.1.5) [NCDHHS, 2022].

Rationale/Importance

The SDOH of e-cigarette use among adolescents in Burke County, NC, is a public health priority due to its significant impact on the well-being of this vulnerable population. Addressing this issue is crucial to mitigate both immediate and long-term health risks. The consequences of respiratory and cardiovascular effects directly impact day-to-day health, necessitating urgent intervention. Moreover, the long-term repercussions, such as the development of lasting addiction and compromised lung function,

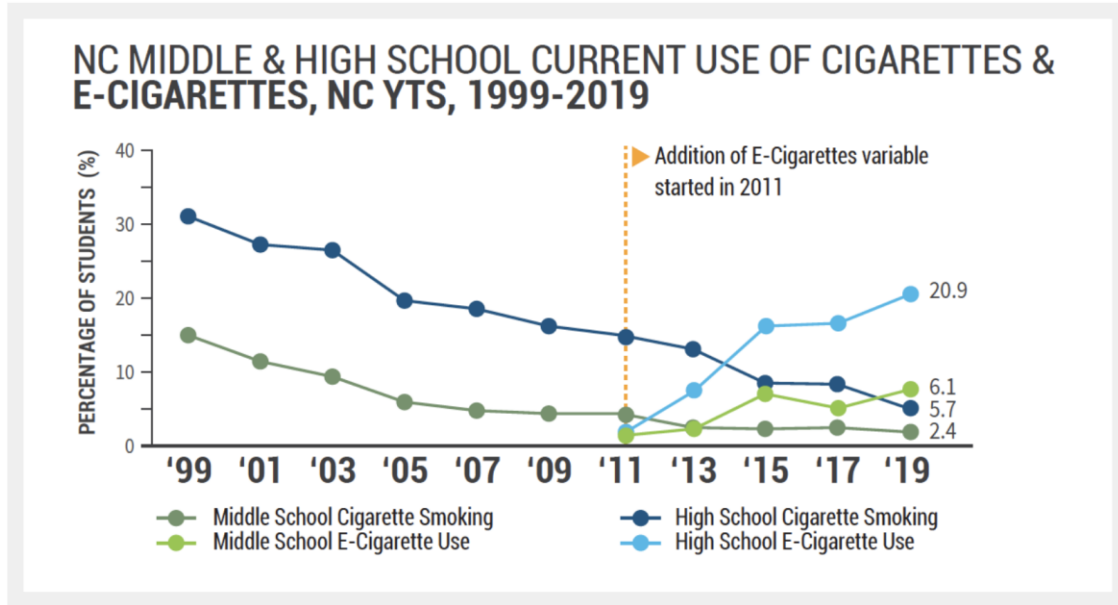
emphasize the need for early intervention to prevent sustained health challenges into adulthood.

Additionally, addressing e-cigarette use during adolescence can help reduce the risk of it serving as a gateway to other tobacco products, drugs, and alcohol.

The priority population and growing population for this SDOH issue is adolescents, as evidenced by the implementation of an anti-vaping policy by Burke County Public Schools. This policy reflects the growing concern about the rising trend of e-cigarette usage among young individuals. Despite challenges in detection and prevalence underestimation, efforts extend beyond punitive measures, with plans to pilot a vape-detector program and comprehensive strategies involving education and intervention. The commitment to early intervention, education, and collaboration underscores the need to prioritize this SDOH among adolescents in Burke County, aiming for a positive impact on their current and future health outcomes.

Appendix D.1.a: SDOH Individual Tables and Figures

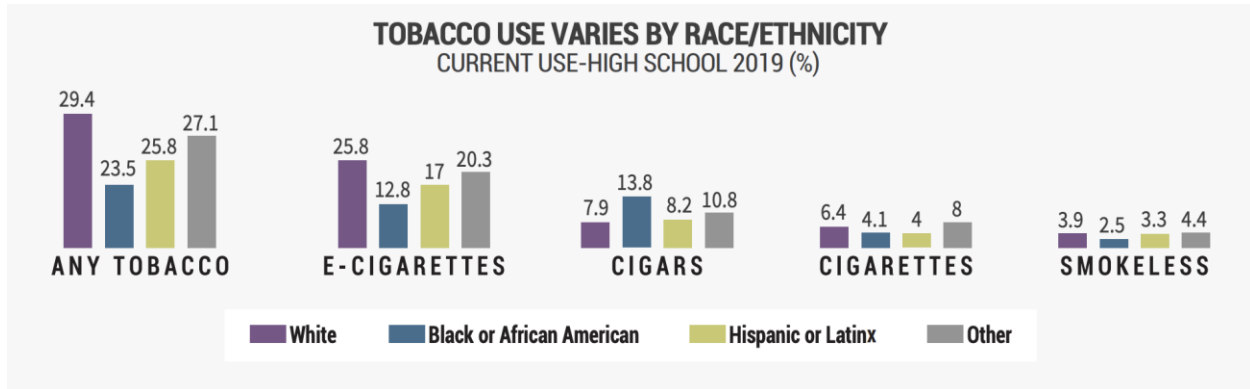
Figure D.1.1: NC Middle & High School Current Use of Cigarettes & E-Cigarettes, NC YTS, 1999-2019



Note: This image was produced by the North Carolina Department of Health and Human Services Tobacco and Prevention Branch from the North Carolina Youth Tobacco Survey Middle & High School Fact Sheet.

North Carolina Department of Health and Human Services. (2023, May). *Chronic Disease and Injury: N.C. Youth Tobacco Survey*. <https://tobaccopreventionandcontrol.dph.ncdhhs.gov/data/yts/docs/2022-NCYTS-Factsheet-Infographic.pdf>

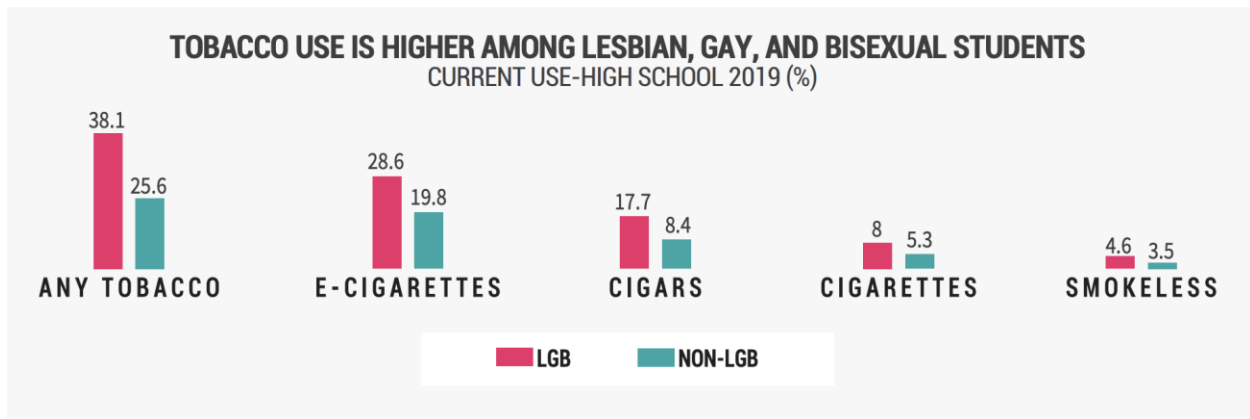
Figure D.1.2: Tobacco Use Varies by Race/Ethnicity



Note: This image was produced by the North Carolina Department of Health and Human Services Tobacco and Prevention Branch from the North Carolina Youth Tobacco Survey Middle & High School Fact Sheet.

North Carolina Department of Health and Human Services. (2023, May). *Chronic Disease and Injury: N.C. Youth Tobacco Survey*. <https://tobaccopreventionandcontrol.dph.ncdhhs.gov/data/yts/docs/2022-NCYTS-Factsheet-Infographic.pdf>

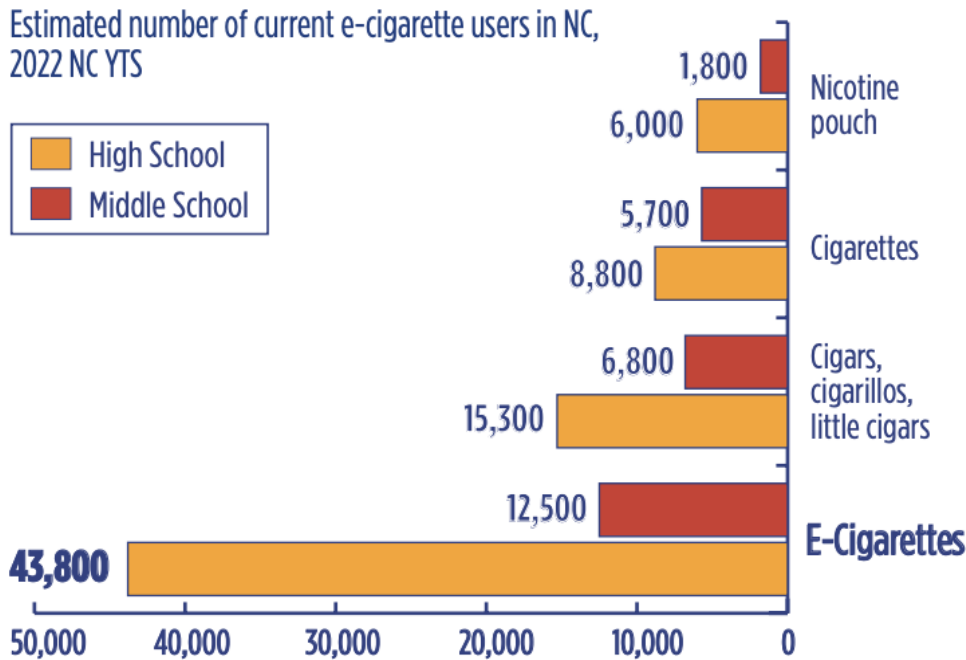
Figure D.1.3: Tobacco Use is Higher Among Lesbian, Gay, and Bisexual Students



Note: This image was produced by the North Carolina Department of Health and Human Services Tobacco and Prevention Branch from the North Carolina Youth Tobacco Survey Middle & High School Fact Sheet.

North Carolina Department of Health and Human Services. (2023, May). *Chronic Disease and Injury: N.C. Youth Tobacco Survey*. <https://tobaccopreventionandcontrol.dph.ncdhhs.gov/data/yts/docs/2022-NCYTS-Factsheet-Infographic.pdf>

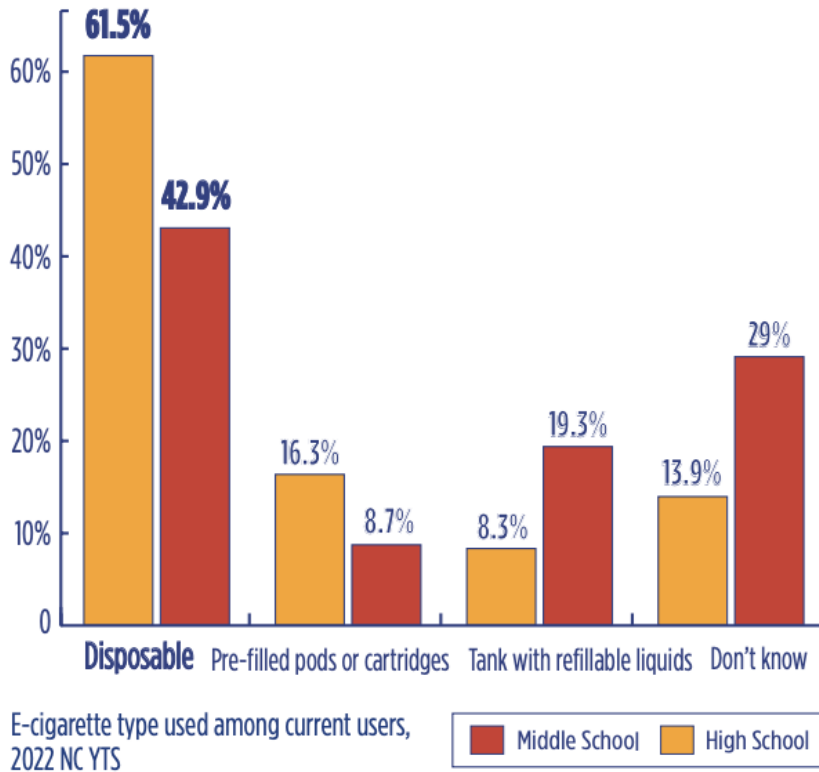
Figure D.1.4: Estimated Number of Current E-cigarette Users in NC, 2022 NC YTS



Note: This image was produced by the North Carolina Department of Health and Human Services Tobacco and Prevention Branch from the North Carolina Youth Tobacco Survey Middle & High School Fact Sheet.

North Carolina Department of Health and Human Services. (2023, May). *Chronic Disease and Injury: N.C. Youth Tobacco Survey*. <https://tobaccopreventionandcontrol.dph.ncdhhs.gov/data/yts/docs/2022-NCYTS-Factsheet-Infographic.pdf>

Figure D.1.5: E-cigarette Type Used Among Current Users, 2022 NC YTS



Note: This image was produced by the North Carolina Department of Health and Human Services Tobacco and Prevention Branch from the North Carolina Youth Tobacco Survey Middle & High School Fact Sheet.

North Carolina Department of Health and Human Services. (2023, May). *Chronic Disease and Injury: N.C. Youth Tobacco Survey*. <https://tobaccopreventionandcontrol.dph.ncdhhs.gov/data/yts/docs/2022-NCYTS-Factsheet-Infographic.pdf>

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Appendix D.2: System Complexity Analysis

Background

The social determinant of health (SDOH) centered on the neighborhood and built environment underscores the significant influence of physical surroundings on an individual's health and well-being (OASH, n.d.). Tobacco use and exposure to secondhand smoke stand out as notable contributors to heightened health risks within this context (OASH, n.d.). North Carolina's smoking rates surpass the national average, with Burke County exhibiting even higher prevalence rates (BCHD, 2022). Particularly alarming is the prevalence of smoking among adolescents aged 10 to 19, with e-cigarettes emerging as the primary choice within this demographic (NCDHHS, 2022). Despite the implementation of strict no-vaping policies in Burke County Public Schools, adolescent e-cigarette use persists, fueled by the widespread availability of e-cigarettes and compelling marketing tactics (BCPS, 2023). For instance, within Burke County Public Schools, there are five middle schools and four high schools, each surrounded by six smoke shops. This underscores the multifaceted challenge of reducing access and exposure to e-cigarettes.

This urgent health concern underscores the critical role of the built environment in shaping community health outcomes, necessitating collaborative efforts to address the social determinant of health related to adolescent e-cigarette use (Gordon et al., 2022; Huizink, 2022; CHA, 2023; Health Community NC, 2023). Zoning officials from the Community Development Department play a pivotal role in this endeavor, possessing the authority to regulate the location and density of tobacco retailers, especially near schools (BCPS, 2023). Effective collaboration with diverse stakeholders, including zoning officials, is essential for comprehensive intervention strategies (Koon, 2023).

By engaging stakeholders from various domains, such as public health, education, law enforcement, and local governance, interventions can address the multifaceted nature of adolescent e-cigarette use (OASH, n.d.). Community partner engagement fosters ownership and buy-in, promoting inclusivity and equity in intervention development and implementation (OASH, n.d.). Through these

collaborative efforts, interventions can be tailored to address the unique needs of different segments of the population, ensuring equitable and responsive solutions (OASH, n.d.).

System & Area of Concern

The system aiming to decrease e-cigarette use among adolescents in Burke County, NC exhibits characteristics of a wicked problem related to the widespread availability and accessibility of e-cigarettes, contributing to high rates of adolescent usage. Specifically, the built environment encompasses various aspects such as retail locations and marketing strategies that contribute to the accessibility of e-cigarettes for adolescents. The solutions to address this issue are not easily enumerable or exhaustively describable because the issue is multifaceted. For instance, restricting the number of stores selling e-cigarettes may be considered, but this alone may not address marketing tactics that influence adolescents. Moreover, there is no well-defined set of permissible operations due to the complex interplay of factors within the built environment.

Moreover, implementing policies or interventions related to the built environment, such as zoning restrictions or marketing regulations, requires careful consideration because there is limited room for trial-and-error. Each attempt to address the built environment's role in e-cigarette availability significantly impacts the overall success of the system to reduce adolescent usage.

Complexity of the System

The SDOH regarding e-cigarette use among adolescents in Burke County is influenced by a complex interplay of factors operating at various levels as depicted in the causal loop diagram (CLD) [see Figure D.2.1]. At the individual level, exposure to advertisements increases interest and curiosity, potentially leading to e-cigarette use. Peer influence within the school environment further amplifies this cycle, as increased e-cigarette use fosters curiosity and acceptance among adolescents. Additionally, anti-vaping policies in schools and the use of detection tools, triggered by prevalent e-cigarette use, may inadvertently lead to discreet use, contributing to sustained usage. The addictive nature of e-cigarettes may result in rebellious behavior, acting as a gateway to other substances and compromising the overall

health and well-being of adolescents, which, in turn, perpetuates the cycle of e-cigarette use. The addictive nature can also heighten the likelihood of tobacco use in adulthood potentially influencing family members and future generations, thereby normalizing tobacco use within the household environment. Furthermore, the availability of e-cigarettes at local shops not only influences adolescents directly but also contributes to family members' tobacco use, creating an environment that fosters curiosity and the normality of tobacco use. On a balancing note, the health consequences of e-cigarette use, such as decreased well-being, may act as deterrents, providing a counterbalancing effect on the prevalence of e-cigarette use among adolescents.

In addition, the CLD illustrates the operation of the "Fixes that Fail" system archetype. This archetype is characterized by well-intended actions or interventions aimed at addressing a problem inadvertently exacerbating the problem over time (Ramaswamy. *Complex Systems Behaviors in Practice* [Module Five], 2023). In the CLD (see Figure D.2.2), various reinforcing loops, such as exposure to advertisements, peer influence, adoption of discreet e-cigarette use due to anti-vaping policies, addiction leading to rebellious behavior, and the normalization of tobacco use within the household environment, contribute to the perpetuation of e-cigarette use among adolescents. Despite efforts to implement policies and interventions to curb e-cigarette use, these actions may unintentionally reinforce the behavior they seek to mitigate. For example, anti-vaping policies in schools and the use of detection tools, triggered by prevalent e-cigarette use, may inadvertently lead to discreet use and sustained usage. This dynamic highlights the complexity of addressing SDOH and underscores the importance of carefully considering the unintended consequences of interventions to achieve sustainable solutions.

Case for Transformation

In the system of e-cigarette use among adolescents in Burke County, a critical case for transformation lies in addressing the availability of e-cigarettes and the multitude of tobacco shops near schools, and comprehensive educational programs on the health consequences of e-cigarette use. This environmental factor serves as a powerful leverage point that, if transformed, could significantly impact

adolescent e-cigarette use. By enforcing policies that impose stricter regulations on marketing and sales practices, and by limiting the number of tobacco shops near schools while overseeing the availability of e-cigarettes near educational facilities, key stakeholders such as school administrators, policymakers, and local healthcare professionals can disrupt the reinforcing loop associated with easy access to these products. Transforming the built environment around schools would signify a fundamental shift in organizing principles and institutional infrastructure, emphasizing the creation of healthier surroundings that actively discourage e-cigarette use among students.

Another leverage point lies in educational programs focused on health consequences. By investing in initiatives that raise awareness about the detrimental health effects of e-cigarette use, the key stakeholders can influence mindsets and behaviors, creating a balancing loop that counters the reinforcing cycle associated with addiction and gateway behaviors. Changing the mindset within the community to prioritize the importance of education on health consequences is pivotal for accelerating progress in reducing e-cigarette use among adolescents. This leverage point signifies a shift in information flows and community organizing principles, as commissioners need to advocate for and invest in initiatives that provide accurate information and empower adolescents to make informed choices. This transformation underscores the importance of holistic approaches that address both environmental factors and educational initiatives to effectively reduce e-cigarette use among adolescents in Burke County.

Insights, Strengths, and Weaknesses

Developing the CLD for e-cigarette use among adolescents in Burke County provided valuable insights into the intricate dynamics of the system. The reinforcing loops highlighted the self-reinforcing nature of certain behaviors, such as peer influence leading to increased curiosity and e-cigarette use, and the potential unintended consequences of anti-vaping policies, such as the adoption of discreet e-cigarette use. The balancing loops emphasized the potential for interventions, such as anti-vaping policies in schools and educational programs, to counteract and slow down the reinforcing cycles. The CLD

underscored the importance of considering multiple levels, including individual, family, community, and institutional factors, in understanding the complexity of the issue.

Regarding limitations, further study and research are warranted in several areas. First, a deeper understanding of the specific mechanisms and effectiveness of anti-vaping policies in schools is needed, including how policies may inadvertently lead to discreet e-cigarette use among adolescents.

Additionally, more research on the impact of different educational strategies and messaging regarding the health consequences of e-cigarette use could inform the development of more effective prevention programs. Further investigation into the influence of family tobacco use on adolescents and the potential for family-based interventions is also essential. Longitudinal studies tracking the evolving landscape of e-cigarette use and its consequences in the county could provide valuable insights into the effectiveness of interventions over time.

However, on the positive side, the CLD offers a visual representation of the interconnected variables, emphasizing the need for a comprehensive and multi-level approach to address e-cigarette use among adolescents. It provides a foundation for further discussions, interventions, and research initiatives. The strengths lie in its ability to highlight potential leverage points and the dynamic nature of the system, encouraging stakeholders to consider a holistic strategy for addressing the public health issue in Burke County.

Appendix D.2.a: System Complexity Individual Tables and Figures

Figure D.2.1: Causal Loop Diagram (CLD)

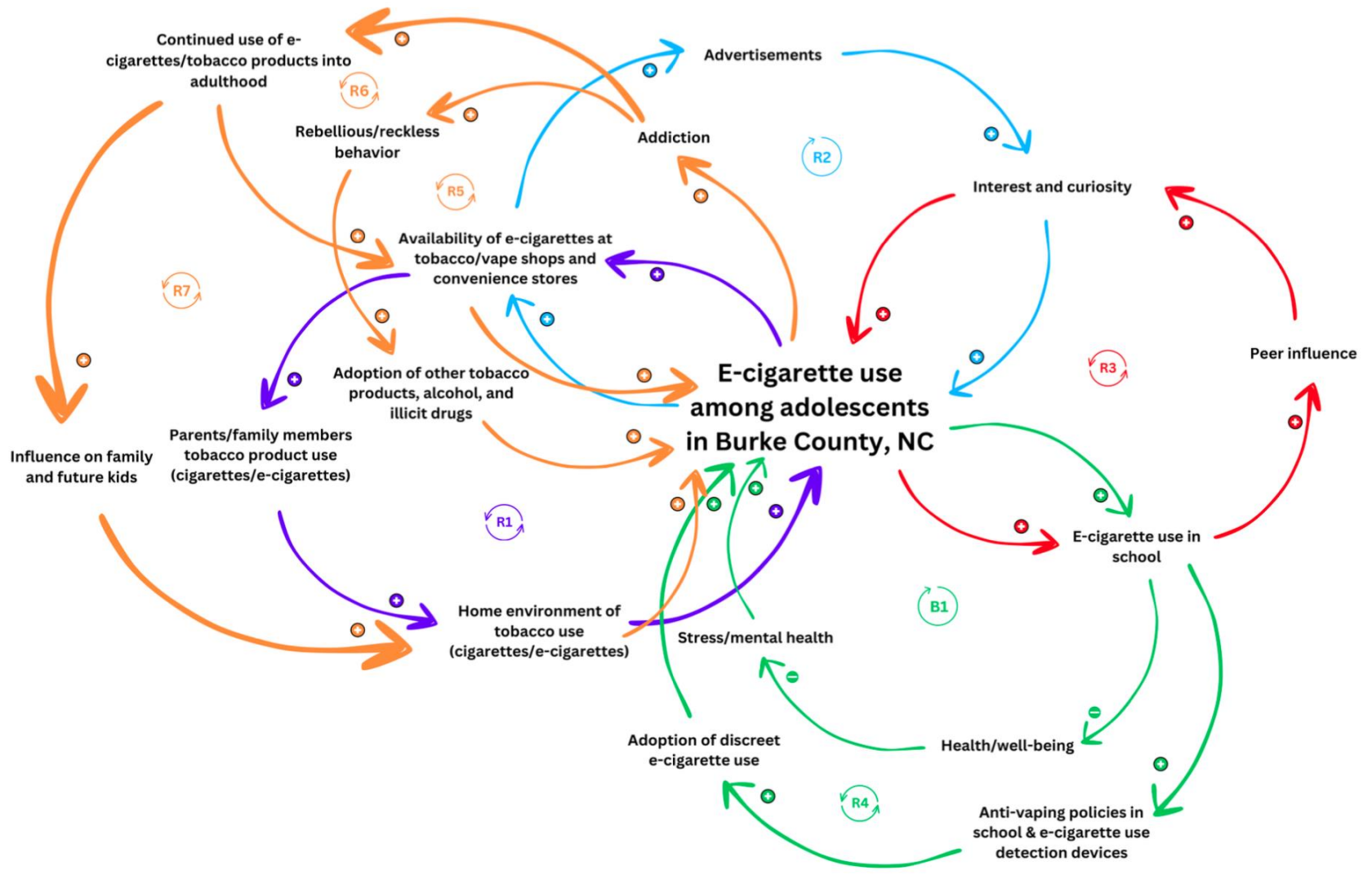
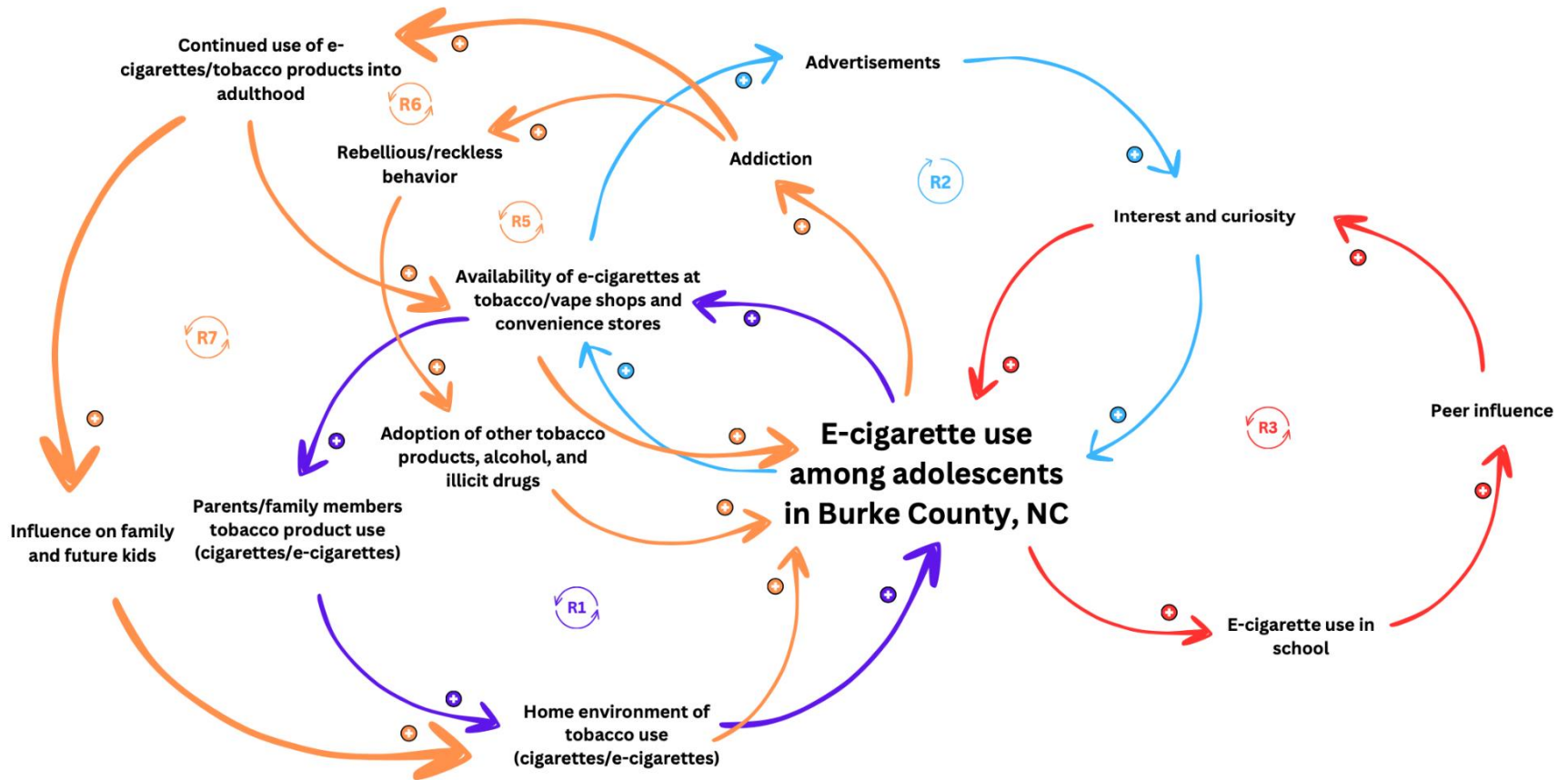


Figure D.2.2: System Archetype Fixes That Fail

The reinforcing loops, R1, R2, R3, R5, R6, and R7 help illustrate how each factor contributes to the reinforcement of e-cigarette use among adolescents in Burke County, NC, creating a self-perpetuating cycle that may inadvertently worsen the problem despite efforts to address it.



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Appendix D.3: Engagement Strategy

Purpose

The social determinant of health (SDOH) centered on the neighborhood and built environment underscores the significant influence of physical surroundings on an individual's health and well-being (OASH, n.d.). Tobacco use and exposure to secondhand smoke stand out as notable contributors to heightened health risks within this context (OASH, n.d.). North Carolina's smoking rates surpass the national average, with Burke County exhibiting even higher prevalence rates (BCHD, 2022). Particularly alarming is the prevalence of smoking among adolescents aged 10 to 19, with e-cigarettes emerging as the primary choice within this demographic (NCDHHS, 2022). Despite the implementation of strict no-vaping policies in Burke County Public Schools, adolescent e-cigarette use persists, fueled by the widespread availability of e-cigarettes and compelling marketing tactics (BCPS, 2023). For instance, within Burke County Public Schools, there are five middle schools and four high schools, each surrounded by six smoke shops. This underscores the multifaceted challenge of reducing access and exposure to e-cigarettes.

Addressing adolescent e-cigarette use in Burke County necessitates a comprehensive and enduring approach, rather than short-term fixes. Engaging community partners transcends mere participation; it embodies a collaborative endeavor involving diverse stakeholders and sectors within the community (Heifetz, Grashow, Linsky, 2009; Herchmer, 2012). Effective collaboration with a wide array of stakeholders is paramount for instigating systemic change that not only identifies and targets immediate issues surrounding adolescent vaping but also tackles the underlying factors within the built environment.

In the broader context of systemic change initiatives, robust collaboration with diverse stakeholders is vital. Community partners bring a wealth of expertise and perspectives from various domains, including public health, education, law enforcement, and local governance. This diversity of viewpoints enhances our comprehension of the multifaceted nature of adolescent e-cigarette use and its repercussions on community health. Furthermore, involving community partners in decision-making

processes fosters ownership and commitment from key stakeholders, promoting greater accountability (Herchmer, 2012). Through engagement at every stage, from planning to implementation and evaluation, interventions become not only effective but also sustainable in the long term (Heifetz, Grashow, Linsky, 2009).

Priority Partner

Among the various community partners identified in the comprehensive effort to address adolescent e-cigarette use in Burke County, zoning officials from the Community Development Department emerge as pivotal players. Their expertise in land use and zoning regulation directly influences the built environment, shaping the physical spaces where community members live, work, and play. This influence has significant implications for community health outcomes, particularly concerning adolescent health and well-being.

Zoning officials hold a unique position of authority, empowered to regulate the location and density of various establishments, including tobacco retailers. Their decisions regarding zoning policies directly impact the accessibility of tobacco products to adolescents, with potential ramifications for rates of e-cigarette use among youth. Specifically, zoning regulations can govern the proximity of tobacco retailers to sensitive locations such as schools and recreational areas frequented by adolescents (see Figure D.3.1).

By leveraging their expertise and authority, zoning officials have the potential to enact policies and regulations that mitigate the risk factors associated with adolescent e-cigarette use. For instance, they can implement zoning ordinances that restrict the density of tobacco retailers near schools or impose buffer zones to limit the proximity of these establishments to areas where youth congregate. Additionally, zoning officials can collaborate with other stakeholders, such as public health agencies and community organizations, to develop comprehensive strategies for tobacco control and prevention.

Furthermore, zoning officials play a critical role in addressing disparities in tobacco retailer density and access within communities. By incorporating health considerations into zoning decisions and land use planning, they can create environments and neighborhoods that support healthy behaviors and

discourage tobacco use among adolescents. This proactive approach to community planning not only promotes public health but also fosters environmental equity by ensuring that all residents, regardless of their socioeconomic status or neighborhood of residence, have access to environments that promote well-being.

Engagement Barriers and Facilitators

One significant barrier to engaging zoning officials is their limited interest or awareness regarding the health implications of e-cigarette retail proximity to schools. Zoning officials may not perceive e-cigarette retail proximity as a pressing health concern or may lack awareness of the correlation between tobacco retailer density near schools and adolescent e-cigarette use rates. To address this barrier, it is essential to provide evidence-based data demonstrating the link between tobacco retailer density near schools and increased rates of adolescent e-cigarette use. By presenting compelling evidence, we can raise awareness among zoning officials and garner support for regulatory changes aimed at reducing adolescents' access to tobacco products.

Additionally, competing priorities and workload constraints within the Community Development Department may hinder active engagement of zoning officials in addressing adolescent e-cigarette use. Zoning officials often have numerous responsibilities and may face pressure to allocate their time and resources to other pressing issues. To overcome this barrier, it is important to offer flexible engagement opportunities that accommodate officials' schedules and workload constraints. This could involve scheduling periodic stakeholder meetings or targeted workshops at times that are convenient for zoning officials, ensuring their participation in the collaborative process without placing undue burden on their existing workload.

Furthermore, resistance to regulatory changes from business stakeholders or community members opposed to zoning restrictions on tobacco retailers presents another challenge to engaging zoning officials effectively. Local businesses and community members may resist zoning restrictions on tobacco retailers due to concerns about economic impacts or perceived infringement on individual rights. To mitigate this resistance and foster collaboration, it is essential to conduct community forums or focus groups that bring

together zoning officials, local businesses, residents, and other stakeholders. These forums provide a platform for dialogue and exchange of perspectives, allowing stakeholders to voice their concerns and interests openly. By emphasizing the shared goal of promoting adolescent health and well-being in these forums, consensus can be built, resistance can be overcome, and collaborative decision-making around regulatory changes aimed at reducing adolescent e-cigarette use can be promoted.

Engagement Methods

In the design phase, stakeholder workshops serve as a pivotal engagement method (Community Toolbox, n.d.) [see Table D.3.1]. These workshops convene zoning officials, public health experts, and community members to deliberate on the impact of zoning policies concerning tobacco retailer proximity to schools. By providing a platform for comprehensive discussions and collaborative problem-solving, these workshops aim to address the limited awareness among zoning officials regarding the health implications of e-cigarette retail proximity to schools. Moreover, fostering dialogue and exchanging perspectives within these workshops can help alleviate potential resistance to regulatory changes from business stakeholders or community members (Heifetz, Grashow, Linsky, 2009; Herchmer, 2012).

Transitioning to the improve phase, policy briefings tailored to zoning officials become instrumental (Community Toolbox, n.d.) [see Table D.3.1]. These individualized briefings furnish officials with updated data on adolescent e-cigarette use trends and the effectiveness of existing zoning regulations. By delivering concise and pertinent information, these briefings directly target the competing priorities and workload constraints within the Community Development Department. Despite the officials' busy schedules, these briefings ensure that they remain informed and engaged, thus facilitating their active participation in the ongoing efforts to address the SDOH related to e-cigarette use among adolescents.

Lastly, in the sustain and scale phase, community forums play a vital role in maintaining ongoing engagement and fostering collaboration among various stakeholders (Community Toolbox, n.d.) [see Table D.3.1]. These forums are open to zoning officials, local businesses, parents, educators, and other relevant stakeholders. By promoting transparency, community engagement, and shared decision-making,

these forums aim to address any lingering resistance to regulatory changes. Additionally, they provide a platform to present evidence-based data and share community perspectives, thus addressing the limited awareness among zoning officials regarding the health implications of e-cigarette retail proximity to schools. Through these forums, the momentum of collective efforts can be sustained and ensure continued progress in addressing the SDOH related to adolescent e-cigarette use in Burke County.

Appendix D.3.a: Engagement Strategy Individual Figures and Tables

Figure D.3.1: Google Maps displaying tobacco retail shops within 0.5 mile of Burke Middle College, a Burke County Public School



Note: The three smoke retail shops are Morganton Tobacco & Vape, Carolina Vape Kings, and Tobacco Barn #1.

Table D.3.1: Engagement Table

Engagement Method	Related Facilitator(s) / Barrier(s)	Timing	Performance Measure
Stakeholder Workshops	Limited awareness among zoning officials regarding health implications of e-cigarette retail proximity to schools; Resistance to regulatory changes from business stakeholders or community members opposed to zoning restrictions on tobacco retailers.	Design Phase	Number of zoning officials showing increased awareness; Level of consensus achieved on regulatory changes.
Policy Briefings	Competing priorities and workload constraints within the Community Development Department	Improve Phase	Percentage of zoning officials attending briefings; Feedback on clarity and usefulness of information provided.
Community Forums	Resistance to regulatory changes from business stakeholders or community members opposed to zoning restrictions on tobacco retailers; Limited awareness among zoning officials regarding health implications of e-cigarette retail proximity to schools.	Sustain/Scale Phase	Attendance rate of stakeholders; Number of actionable insights generated from forums.

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APPENDIX E: RICHAUN RIDDICK INDIVIDUAL DELIVERABLES

Appendix E.1. Social Determinants of Health Analysis

Social Determinants of Health

The social determinant of health category "neighborhood and built environment" centers on how the neighborhoods and environments where people live, significantly influence their health and well-being (OASH, n.d.). Within that category, there is a particular emphasis on individuals who are exposed to health risks such as tobacco use (OASH, n.d.). Tobacco use exacerbates health risks within your neighborhood and built environment, leading to increased incidences of respiratory issues, cardiac morbidities, or death. (OASH, n.d.). Tobacco exposure affects not only the individual user but also those close to the user, who may be impacted by health concerns arising from tobacco use or how they attend to the user.

The built environment surrounding tobacco use in Burke County is a contributing factor to the high rates of adolescent usage. There are five middle and four high schools within Burke County Public Schools, with sixteen smoke shops in close proximity to these schools, some less than a mile away, others less than a 10-minute drive (see Appendix E.1.a. Figure E.1.1 and Figure E.1.2). Studies indicate that schools located in areas with a higher density of stores tend to have a higher prevalence of smoking compared to schools situated in areas with fewer nearby retailers. (Counter Tobacco, 2022). Evidence from documents obtained from tobacco companies reveals that corporate marketers have strategically targeted convenience stores, grocery stores, and other tobacco vendors located near schools and playgrounds to attract young smokers (Counter Tobacco, 2022). Reducing access and exposure to tobacco presents a multifaceted challenge.

This is due to its widespread availability, easy accessibility, proximity of retail locations, and local marketing campaigns, all intertwined within the built environment.

Adolescent smoking in North Carolina is higher than the smoking average in the U.S. with 19% of NC adolescents being smokers compared to the U.S. average of 16% of adolescents as of 2022 (Burke

County Health Department [BCHD], 2022). State-specific data shows adolescent smoking in North Carolina is also higher than the state average with 19.7% of adolescents smoking compared to the state average of 16.9% (BCHD, 2022). Adolescent smoking has been a rising problem in Burke County since 2011 with e-cigarettes, a form of tobacco, being the most used and preferred form of smoking among this population (North Carolina Department of Health and Human Services [NCDHHS], 2023). E-cigarettes are the number one form of tobacco use among adolescents in North Carolina as a whole (NCDHHS, 2023). As e-cigarettes and vaping flavors targeted toward younger audiences gained popularity, schools in the Burke County Public School system witnessed a rise in the use of e-cigarettes (Burke County Public Schools [BCPS], 2023). Due to the increase in adolescent smoking, Burke County Public Schools implemented a no-vaping policy on school buildings, school grounds, buses, or during school-sponsored activities off-campus (BCPS, 2023). This new policy is the first of its kind in North Carolina with set consequences for students found vaping, carrying vaping paraphernalia, or smoking (BCPS, 2023). Due to the policy being relatively new, a decrease in the number of adolescent e-cigarette users is unable to be determined at this time.

Geographic and Historical Context

To gain a better understanding of the influence of tobacco use in Burke County, NC, and its higher-than-state average rates, it's essential to delve into North Carolina and Burke County's extensive history with tobacco. Tobacco has deep roots in the history of North Carolina. Dating back to before the sixteenth century, Native Americans residing in the area were growing tobacco and using it for ritualistic and medicinal purposes deeming it their "holy herb" (Yeargin, 2022). By the late sixteenth century, tobacco production would begin and continue to increase throughout the eighteenth and nineteenth centuries becoming one of the leading cash crops in North Carolina (Yeargin, 2022). Eventually, Burke County joined the tobacco manufacturing process, having a tobacco factory before 1840 (Yeargin, 2006). As the twentieth century unfolded, North Carolina gained global recognition as America's leading supplier of tobacco (Yeargin, 2006).

In the early 1950s tobacco production began to decline in North Carolina due to health-related media articles and congressional hearings on smoking and health (Yeargin, 2006). After the U.S. Surgeon General's Report on Smoking and Health in 1964 and a surge of over 400 successful lawsuits against smoking corporations, the demand for tobacco fell (Yeargin, 2006). Even though the tobacco industry is not as popularized as it once was in North Carolina, it continues to have a major influence on the economic and cultural identity of the state (Yeargin, 2006). As of 2017, Burke County, NC is no longer receiving profits from tobacco sales however it still has a high smoking profile amongst its residents (Census of Agriculture, 2017).

Priority Population

Burke County, NC has a population of 90,418 residents with 18.7% of the population being aged 5-18 years old as of 2022 (Burke Community Health Assessment [BCHA], 2022). The demographics in this area are predominantly White, Non-Hispanic at 81.2%, followed by Hispanic/Latinx at 6.7%, Black Non-Hispanic at 6.5%, Asian at 3.7%, and American Indian at 0.90% (BCHA, 2022). The priority population of focus will be the adolescent population, ages 10-19. According to the Healthy North Carolina 2030 Report, e-cigarette use among this population has become an epidemic in North Carolina and poses a public health threat (North Carolina Institute of Medicine [NCIOM], 2020). Given that Burke County's adolescent smoking rate surpasses the state average and there's limited available data on tobacco use among this demographic compared to adults, it's imperative to prioritize this population for focus.

Measures of Problem - Scope

Public schools in North Carolina have taken part in a North Carolina Youth Tobacco Survey (NC YTS) every two years since 1999 (North Carolina Department of Health and Human Services [NCDHHS], 2023). This survey measures youth tobacco use behaviors for students in grades 6-12 via random sampling of schools statewide (NCDHHS, 2023). The 2022 NC YTS found that 18,600 middle school students and 57,300 high school students use tobacco products with the number one tobacco product being e-cigarettes for a combined total of 43,800 students (see Appendix E.1.a Figure E.1.3 and Figure E.1.4) (NCDHHS, 2023). Flavored products are used by almost all e-cigarette users and 25% of

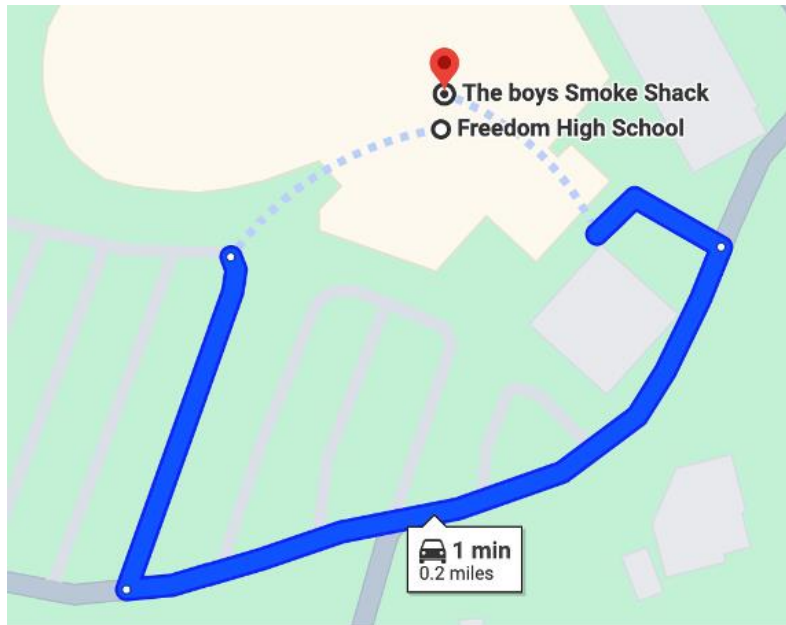
high school and 33% of middle school tobacco users find it hard to get through their day without vaping (NCDHHS, 2023). Although the data from this survey is not based on Burke County, it aligns with Burke County's no vaping at school policy. Furthermore, based on Burke County's Community Health Assessment, no updated data was given on adolescent tobacco use as of 2022. This has been identified as a gap in the data for their Community Health Assessment and invites the opportunity to further focus on adolescent tobacco use in Burke County, NC. For this purpose, the North Carolina Youth Tobacco Survey was used.

Rationale

Addressing the social determinants of health requires prioritizing the issue of smoking and vaping tobacco products among adolescents. While strides are being made in the U.S. to boost the prevalence of smoke-free homes, North Carolina, along with its adolescent population, still lags in this progress. (NCDHHS, 2022). Focusing on smoking cessation will align with the Healthy People 2030 goals as well as create a better neighborhood and built environment for Burke County, North Carolina by eliminating health hazards and comorbidities associated with smoking. There is a wealth of positive benefits for the county and the state when addressing adolescent smoking and vaping cessation such as increased mental health and well-being, a healthier adolescent population, and lowered long-term morbidities associated with smoking (CDC, 2021).

Appendix E.1.a: Social Determinants of Health Analysis Individual Tables and Figures

Figure E.1.1: The Distance from Freedom High School to The Boys Smoke Shop

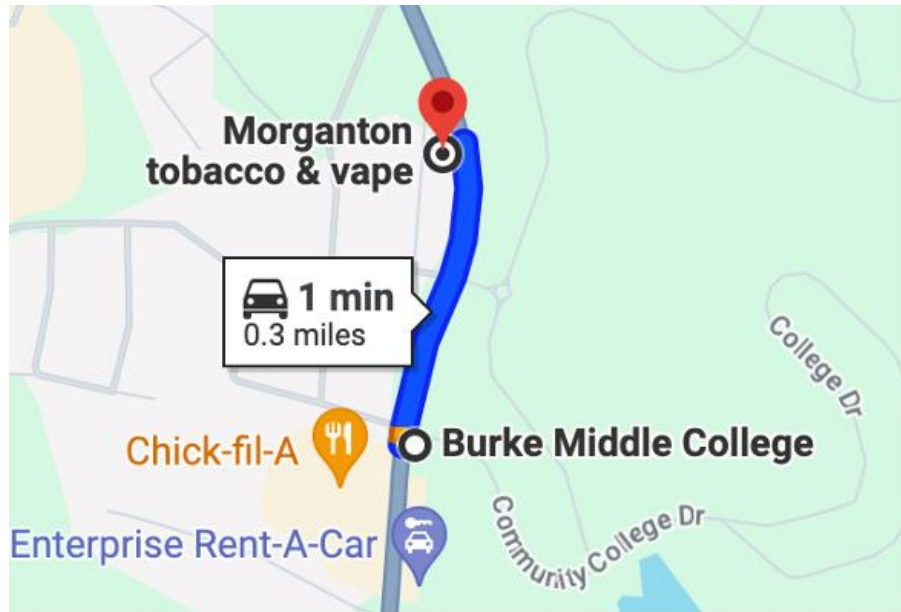


Note. Retail smoke shop only 0.2 miles away from Freedom High School.

Google. (n.d.). [Google Maps showing the location of a tobacco retailer near Freedom High School]. Retrieved March 17, 2024, from

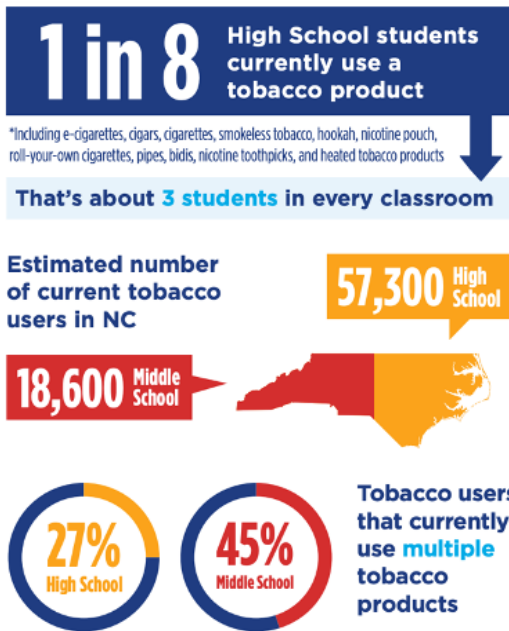
<https://www.google.com/maps/dir/Freedom+High+School,+511+Independence+Blvd,+Morganton,+NC+28655/The+boys+Smoke+Shack,+Freedom+Park,+Morganton,+NC/@35.7463757,-81.7211051,16.48z/data=!4m14!4m13!1m5!1m1!1s0x8850ce43eaf75133:0xc32ef83d1f1c18bb!2m2!1d-81.719683!2d35.744524!1m5!1m1!1s0x8850cfe0d0dc3eab:0x4ff684f46ee9f070!2m2!1d-81.7196728!2d35.7446145!3e0?entry=tту>

Figure E.1.2: The Distance from Burke Middle College (STEAM High School) to Morganton Tobacco & Vape



Note. Retail smoke shop only 0.3 miles away from Burke Middle College.
Google. (n.d.). [Google Maps showing the location of a tobacco retailer near Burke Middle College]. Retrieved March 17, 2024, from <https://www.google.com/maps/dir/Burke+Middle+College,+1001+Burkemont+Ave,+Morganton,+NC+28655/Morganton+tobacco+%26+vape,+Burkemont+Avenue,+Morganton,+NC/@35.7243977,-81.6955977,17z/data=!3m1!4b1!4m14!4m13!1m5!1m1!1s0x8850d1fc4afc512b:0x30993224aa040d6f!2m2!1d-81.6933526!2d35.7224937!1m5!1m1!1s0x8850ce1d333a5a27:0x9fe646919c70c483!2m2!1d-81.6929198!2d35.7261589!3e0?entry=tту>

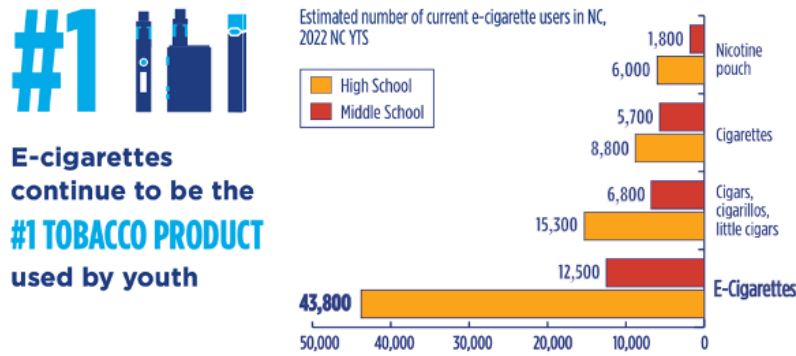
Figure E.1.3: Infographic of High School and Middle School Students Currently Using Tobacco



Note: This image was produced by the North Carolina Department of Health and Human Services Tobacco and Prevention Branch from the North Carolina Youth Tobacco Survey Middle & High School Fact Sheet.

North Carolina Department of Health and Human Services. (2023, May). *Chronic Disease and Injury: N.C. Youth Tobacco Survey*. <https://tobaccopreventionandcontrol.dph.ncdhhs.gov/data/yts/docs/2022-NCYTS-Factsheet-Infographic.pdf>

Figure E.1.4: Types of Tobacco Products Used by Adolescents in North Carolina



Note: This image was produced by the North Carolina Department of Health and Human Services Tobacco and Prevention Branch from the North Carolina Youth Tobacco Survey Middle & High School Fact Sheet.

North Carolina Department of Health and Human Services. (2023, May). *Chronic Disease and Injury: N.C. Youth Tobacco Survey*. <https://tobaccopreventionandcontrol.dph.ncdhhs.gov/data/yts/docs/2022-NCYTS-Factsheet-Infographic.pdf>

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Appendix E.2: Understanding the Value of Reaccreditation in Local Health Departments Through the Lens of Quality

Social Determinant of Health (SDOH) Analysis

The social determinant of health category "neighborhood and built environment" centers on how the neighborhoods and environments where people live significantly influence their health and well-being (OASH, n.d.). Within that category, there is a particular emphasis on individuals who are exposed to health risks such as tobacco use (OASH, n.d.). Tobacco use exacerbates health risks within your neighborhood and built environment, leading to increased incidences of respiratory issues, cardiac morbidities, or death. (OASH, n.d.). Tobacco exposure affects not only the individual user but also those close to the user, who may be impacted by health concerns arising from tobacco use or how they attend to the user.

Smoking in North Carolina is higher than the smoking average in the U.S. (Burke County Health Department [BCHD], 2022). Smoking in Burke County, NC is higher than the state average (BCHD, 2022). Adolescent smoking has been a rising problem in Burke County with e-cigarettes being the most used and preferred form of smoking among this population (North Carolina Department of Health and Human Services [NCDHHS], 2023). E-cigarettes are the number one form of tobacco use among adolescents in North Carolina (NCDHHS, 2023). As e-cigarettes and vaping flavors targeted toward younger audiences gained popularity, schools in the Burke County Public School system witnessed a rise in the use of e-cigarettes (Burke County Public Schools [BCPS], 2023). Due to the increase in adolescent smoking, Burke County Public Schools implemented a no-vaping policy on school buildings, school grounds, buses, or during school-sponsored activities off-campus (BCPS, 2023). Despite the presence of that policy, it has not resulted in a decrease in the number of adolescent e-cigarette users. The built environment encompassing e-cigarette use in Burke County is a contributing factor to the high rates of adolescent usage. There are five middle schools and four high schools within Burke County Public Schools, with six smoke shops in close proximity to these schools. Reducing the usage of e-cigarettes

presents a multifaceted challenge tied to their widespread availability, easy accessibility, proximity of retail locations, and marketing strategies, all intertwined within the built environment.

Project Title

Decrease e-cigarette use among adolescents in Burke County, NC.

Problem Statement

Education and smoking cessation programs are needed due to adolescent e-cigarette usage continuing to rise in Burke County, NC leading to long-term increased health risks and lower quality of life among this population.

Aim Statement

We aim to reduce e-cigarette use among adolescents in Burke County, NC. We will accomplish this by the end of the 2024-2025 school year. This is important because:

- The reaccreditation process requires the Burke County Health Department to meet the following activity 10.2 which requires the health department to develop educational materials. Burke County Public Schools established a no vaping at schools policy to take effect in the 2023-2024 school year and educational materials are needed.
- Reducing smoking rates will lead to fewer school suspensions and better long-term health outcomes for our adolescents.

We will achieve this by using QI methods to streamline our smoking cessation efforts by developing, implementing, and evaluating a health promotion campaign for the schools and their surrounding communities to create a better neighborhood and built environment. Our goals are to:

- Decrease the number of school suspensions by 25%.
- Establish a smoking cessation program at the Burke County Public Schools: School Health Advisory Council to be rolled out at all schools in the county.
- Achieve a total of four smoke-free schools or greater, ideally two middle schools, and two high schools.

Focusing on activity 10.2 allows the Burke County Health Department to partner with their local schools, especially those serving lower incomes, to create educational materials and implement programs, in order to reduce e-cigarette usage in the adolescent population. The Burke County Community Health Assessment identifies high smoking rates among adolescents but does not have adequate data to support these claims. This shows a gap in the data for their Community Health Assessment and invites the opportunity to further focus on adolescent tobacco use in Burke County, NC as well as assess policies or interventions related to the built environment.

Internal and External Customers

At the time this project begins, the internal customers involved are the Burke County Health Department Health Promotion team and the Burke County School Administrators. The external customers are the students, their parents, school faculty and staff, smoke shop owners, pediatric providers, and smoking cessation counselors. An improvement process will affect both the internal and external customers by allowing the health department to meet their accreditation needs and bring proper education and assistance to the public school system in Burke County. This process will affect external customers in several ways. Starting with the students, the improvement process will present students with the opportunity to live healthier lives and alleviate long-term health consequences. As for parents, education and smoking cessation programs assist the parents on how to navigate partnering with their teen on how to quit smoking. Parents will also get the opportunity to understand policies and their influence on e-cigarette use and built environment. School faculty and staff can see a decrease in suspensions and an increase in healthier smoke-free schools. Smoke shop owners will be affected differently. These owners will begin to see a decrease in product sales among the adolescent population. Pediatric providers will see a decrease in patient appointments related to smoking morbidities and smoking cessation counselors will see an increase in counseling services.

Overall, an improvement of the process will positively affect all customers involved by lowering school suspensions, creating smoke-free schools, and raising awareness around the neighborhood and physical environment encompassing e-cigarette use. Even the smoke shop owner losing sales

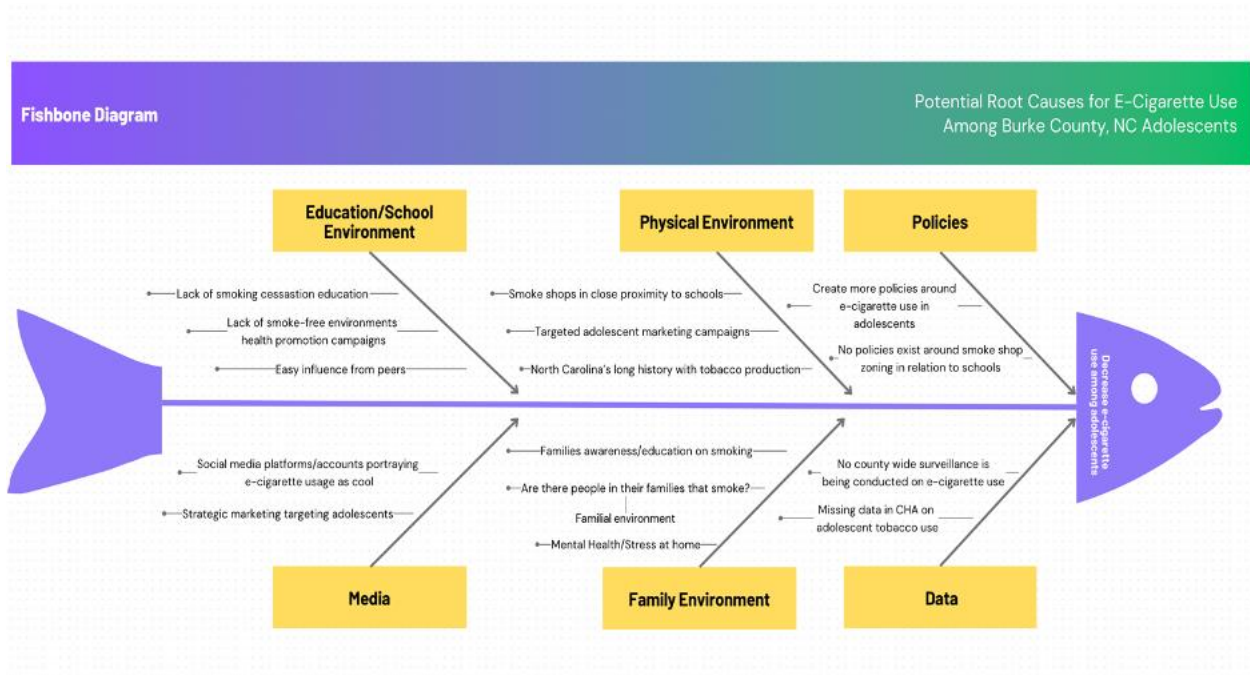
inadvertently has a positive impact on our adolescents because it shows less of this population purchasing tobacco products and paraphernalia. This improvement process will contribute to having a healthier neighborhood and built environment while achieving an accreditation goal.

Project Measures

We will use output, process, outcome, and balancing measures to track our project's performance. Our output measures are educational materials produced by the Burke County Health Department and administered to all public middle and high schools in Burke County Public Schools before the end of the 2023-2024 school year. Also, reduce school suspensions across Burke County Public Schools for e-cigarette use at schools, on school grounds, on buses, or during school-sponsored activities off campus. Our process measures are three weeks before spring break, check in with the health department to see how their smoking cessation education materials are coming along and what is left or needed so they can be delivered to the schools for distribution the week before spring break. The week before summer break, meet with the middle schools and high schools to collect their e-cigarette suspension-related data so we can track if there is an increase, a decrease, or none at all. Track the number of schools or how many schools have received smoking cessation education by the summer break. At the beginning of the 2024-2025 school year set up free smoking cessation counseling services at four schools (two must serve lower-income areas) and track the number of people in attendance. Our outcome measures are how many schools achieved a smoke-free campus by the end of the 2024-2025 school year. Also, the percentage of e-cigarette suspensions by the end of the 2024-2025 school year. Our balancing measures are identifying the schools that need the most assistance with smoking cessation needs and school satisfaction with the health department's assistance. See the attached table in the appendices.

Potential Root Causes

Figure E.2: Potential Root Causes for E-Cigarette Use Among Burke County, NC Adolescents



Note: Fishbone Diagram of Potential Root Causes for E-Cigarette Use Among Burke County, NC Adolescents. Own work.

Appendix E.2.a: Understanding the Value of Reaccreditation in Local Health Departments Through the Lens of Quality Tables and Figures

Table E.2.1: Project Measure Plan

Project Aim: We aim to reduce e-cigarette use among adolescents in Burke County, NC. We will accomplish this by the end of the 2024-2025 school year.

Measurement/ Indicator	Output, Outcomes, Process, Balancing	Operational Definition	Process Step Where Data Will be Collected	How Will Data be Collected?
Number of educational materials produced by the Burke County Health Department and administered to all public middle and high schools	Output	The indicator will be measured by counting the number of educational materials produced.	Burke County Health Department	Manual counts/records from the Health Department
Percent of school suspensions across Burke County Public Schools for e-cigarette use before education received	Output	The indicator will be measured by dividing the total number of suspensions by the total student enrollment.	School Administration	Electronic records; reports from the school
Time it takes for the health department to produce smoking cessation education	Process	The indicator will be measured by the time it takes for the health department to start and finish making the educational materials.	Burke County Health Department	Manual counts/records from the health department

Average number of e-cigarette suspension at the middle & high schools once education has been received	Process	The indicator will be measured by adding up the total number of suspensions and dividing them by the number of schools the data was collected from.	School Administration	Electronic records; reports from the school
The number of schools that have received smoking cessation education by summer break	Process	The indicator will be measured by adding the number of schools together that have received the education by spring break.	Burke County Health Department	Manual counts/records from the health department
Average number of students who attend free smoking cessation counseling	Process	The indicator will be measured by adding up the number of students who attend the smoking cessation counseling and dividing it by the number of schools who are participating in the counseling.	School Administration	Electronic records; reports from the school

Number of schools that achieved a smoke-free campus by the end of the 2024-2025 school year.	Outcome	The indicator will be measured by adding the total number of schools together that achieved a smoke-free campus.	School Administration	Electronic records; reports from the school
Percentage of e-cigarette suspensions by the end of the 2024-2025 school year.	Outcome	The indicator will be measured by dividing the total number of suspensions by the total student enrollment.	School Administration	Electronic records; reports from the school
Number of schools that need the most assistance with smoking cessation needs	Balancing	The indicator will be measured by looking at the schools with the highest e-cigarette suspensions.	Burke County Health Department	Manual counts/records from the health department
Number of schools satisfied with the health department's assistance	Balancing	The indicator will be measured by adding up the number of schools who were satisfied with the health departments assistance.	Burke County Health Department	Manual counts/records from the health department

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Appendix E.3: Assessment, Conflict Resolution, and Sustainability

Social Determinant of Health Overview and County Context

The built environment surrounding e-cigarette use in Burke County is a contributing factor to the high rates of adolescent usage. There are five middle and four high schools within Burke County Public Schools, with sixteen smoke shops in close proximity to these schools, some less than a mile away, others less than a 10-minute drive (see Appendix E.1.A Figure E1 and Figure E2). Studies indicate that schools located in areas with a higher density of stores tend to have a higher prevalence of smoking compared to schools situated in areas with fewer nearby retailers. (Counter Tobacco, 2022). Evidence from documents obtained from tobacco companies reveals that corporate marketers have strategically targeted convenience stores, grocery stores, and other tobacco vendors located near schools and playgrounds to attract young smokers (Counter Tobacco, 2022). Reducing access and exposure to e-cigarettes presents a multifaceted challenge. This is due to their widespread availability, easy accessibility, proximity of retail locations, and local marketing campaigns, all intertwined within the built environment.

Adolescent smoking in North Carolina is higher than the smoking average in the U.S. with 19% of NC adolescents being smokers compared to the U.S. average of 16% of adolescents as of 2022 (Burke County Health Department [BCHD], 2022). State-specific data shows adolescent smoking in North Carolina is also higher than the state average with 19.7% of adolescents smoking compared to the state average of 16.9% (BCHD, 2022). Adolescent smoking has been a rising problem in Burke County since 2011 with e-cigarettes being the most used and preferred form of smoking among this population (North Carolina Department of Health and Human Services [NCDHHS], 2023). E-cigarettes are the number one form of tobacco use among adolescents in North Carolina (NCDHHS, 2023). As e-cigarettes and vaping flavors targeted toward younger audiences gained popularity, schools in the Burke County Public School system witnessed a rise in the use of e-cigarettes (Burke County Public Schools [BCPS], 2023). Due to the increase in adolescent smoking, Burke County Public Schools implemented a no-vaping policy on school buildings, school grounds, buses, or during school-sponsored activities off-campus (BCPS, 2023).

Despite the presence of that policy, it has not resulted in a decrease in the number of adolescent e-cigarette users.

Measures of Success

The steering committee will gauge its success by employing three key benchmarks for data collection: member engagement and satisfaction, community partner initiatives, and progress in planning and implementation. Utilizing the insights from Table E.3.1 RASCI Analysis of Project Goals, the steering committee will leverage three primary data sources to facilitate sustainable change, govern effectively, and enhance their ability to execute priority actions for their community's health as our initiatives progress. Additionally, this tool will aid us in gaining a deeper understanding of our community partners, clarifying their roles and responsibilities, establishing accountability for task completion, and assessing the achievement of our proposed goals.

Member engagement and satisfaction

A common denominator across all three of the project goals is member engagement and satisfaction with representation. When measuring member engagement and satisfaction, the steering committee should establish engagement and satisfaction metrics. Engagement metrics will be measured by keeping a record of participation rates, attendance, and seeing the frequency of interactions between committee members amongst themselves and committee members with community partners. Satisfaction metrics will be measured using surveys and suggestion boxes for our committee members and community partners. Both metrics will be measured monthly using a spreadsheet to track progress toward our goals.

Community Partner Initiatives

Working with our community partners is crucial in reaching our goals. In order to measure our community partner initiatives, we must establish clear objectives we want to achieve while working with them and identify key performance indicators such as the number of community partners consulted and the number attending our meetings. Once the performance indicators have been established, a spreadsheet will record the data. This data will produce qualitative and quantitative data allowing us to see the number

of community partner participants at meetings or events and community partner feedback and satisfaction. This information will be valuable in understanding if we are on track with achieving our goals.

Progress in planning and implementation

To measure our progress in planning and implementation, the steering committee will create a meeting calendar with all scheduled meetings and events as well as expected participants and community partners to be handed out at the first meeting. The data spreadsheets from member engagement and satisfaction and community partner initiatives will be used to assist with tracking the progress in planning and implementation by helping to identify metrics that will indicate progress toward each goal. Once metrics have been established, a goal timeline will be set that aligns with the meetings and events to track where we are with each goal. This will provide a visual representation of the progress and help identify any areas of opportunity.

Conflict Resolution

The steering committee will need to establish and uphold shared agreements about how the group will operate. This may include a team charter with agreed-upon principles of engagement, and a memorandum of understanding (MOU) utilized in the partnerships between the stakeholders. This MOU will include partnership principles such as agreements that all parties will: work with the best interest of the students in mind; prioritize timeliness and open communication in all correspondence; remain open-minded and optimistic in the face of challenges; work collaboratively and supportively; remain professional and respectful (Academic Health Department Partnership Agreements [AHDPA], n.d.). Utilization of MOU can facilitate effective collaboration, allow for agreements to be collectively re-negotiated, and can increase accountability for all members (AHDPA, n.d.).

The goal is to reach a shared consensus on all aspects. If someone disagrees, the committee will make room for shared conversation. This may result in a compromise or a new possible decision. However, in the case of not being able to agree 100%, the committee will utilize the 70% consensus rule from the Detroit Urban Research Center (Detroit Urban Research Center, 2021). If each member can support at least 70% of the decision, after the opportunity for every member to discuss differing opinions,

then the committee will move forward with that decision (Detroit Urban Research Center, 2021). This process will move the work forward in a good way with clean communication that invites diverse perspectives (Detroit Urban Research Center, 2021).

Sustaining Momentum

Establishing group norms that work for all parties will be crucial at the onset of this collaboration for the momentum to sustain over time. The committee will need to collectively create mutual agreements for shared accountability and action, such as the MOU previously discussed. Extra attention must be paid to those in the committee who traditionally have less power (such as students) to ensure all voices are welcome, encouraged, and invited (The Community Tool Box, 2023a). The collaborative culture established by the steering committee will ripple into other aspects of the project. Given the power differentials that will be present in the committee, creating a safe space where all participants feel valued is critical (Yukl, 2013). The steering committee can utilize specific techniques, such as shared agenda setting and round-robin discussions, to ensure all present feel welcome to share their perspectives (Yukl, 2013). This transformational leadership will need to inspire the collective to work towards the shared vision and goals while facilitating conditions for innovative solutions when inevitable challenges arise (Yukl, 2013). The committee will also utilize this opportunity to intentionally amplify student leadership, providing opportunities for youth to lead meetings, set agendas, and share wisdom from their perspective (Miller et al., 2023).

The success of this project requires diverse perspectives from across the community (Yukl, 2013). Community members must see themselves as having meaningful input and bringing value to the collaborative, as the sustainability of this project relies on community buy-in (The Community Tool Box, 2023a). Other leaders already exist in the community, who are either promoting or hindering a tobacco- and vape-free environment, and the steering committee is tasked with discovering where these leaders are and creating a space for them at the table of shared power (The Community Tool Box, 2023b). Thus, these informal leaders, who may not have been initially considered during the design phase, can bring

their expertise and community-based wisdom (The Community Tool Box, 2023b) to improve the implementation of the project in ways specifically relevant to Burke County.

Student advocates can provide recommendations for how to increase awareness of the efforts, including social media marketing and informal student-led conversations at school lunches (Miller et al., 2023). Other stakeholders may provide additional avenues for increasing awareness, such as discussion with pediatric providers at annual visits, the public health department's health fairs, or other creative resources. Community members will have insight into the specific sites where youth gather, such as a specific restaurant or community space, to provide additional engagement opportunities (The Community Tool Box, 2023b). Leveraging partnerships with those sites may open communication opportunities to further promote this change in sustainable and actionable ways (The Community Tool Box, 2023a). By effectively gathering the collective efforts of the community and focusing together on promoting a tobacco- and vape-free Burke school district, a positive impact will be made.

Appendix E.3.a: Assessment, Conflict Resolution, and Sustainability Tables and Figures

Table E.3.1: RASCI Analysis of Project Goals

RASCI Levels	Project Goals		
Who is...	Goal 1- Steering committee membership will include at least five different types of member representation for at least 80% of the meetings for one year.	Goal 2- Increase the number of active* committee members by 20% over the first year of the program. *Active defined as participating in at least 70% of meetings and/or functions.	Goal 3 - Youth representatives will lead at least 25% of the program meetings, including agenda setting and invitee list.
Responsible	<ul style="list-style-type: none"> ● Student Health Advisory Council (SHAC) ● Burke Recovery 	<ul style="list-style-type: none"> ● SHAC ● Burke Recovery 	<ul style="list-style-type: none"> ● SHAC ● Parents
Accountable	<ul style="list-style-type: none"> ● SHAC ● Health Department ● School District 	<ul style="list-style-type: none"> ● SHAC ● Health Department ● School District 	<ul style="list-style-type: none"> ● SHAC ● Health Department ● Parents ● Students
Supportive	<ul style="list-style-type: none"> ● Parents ● Students ● Pediatricians and Health Care Providers 	<ul style="list-style-type: none"> ● Parents ● Students ● Health Department 	<ul style="list-style-type: none"> ● School Staff ● Parents
Consulted	<ul style="list-style-type: none"> ● Vape shop owners ● Zoning officer ● School Nurse ● Tobacco industry marketing (focusing on local staff who display tobacco marketing in tobacco shops) 	<ul style="list-style-type: none"> ● Local faith-based organization leaders ● Adult Participants of Burke County’s Tobacco Cessation program 	<ul style="list-style-type: none"> ● School Administration ● Members of school government
Informed	<ul style="list-style-type: none"> ● Parents ● Students ● School District 	<ul style="list-style-type: none"> ● Parents ● Wider program committee 	<ul style="list-style-type: none"> ● Parents ● School District ● Wider program committee

RASCI Analysis Template from Wandersman, A., Imm, P., Chinman, M., & Kaftarian, S. (2000). Getting to outcomes: a results-based approach to accountability. *Evaluation and Program Planning*, 389–395.

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