Erie County Department of Health and Air Quality Maintenance

A Campaign Plan

Gannon University

GCOMM 625: Health Campaigns

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2019

Step 1: Rationale, Needs and Priorities

Climate change and its relationship to the environment and air pollution and air quality is a major public health concern. The Erie County Department of Health (ECDH) has identified air quality as one of its priority issues. This health campaign will focus on effective ways the ECDH can increase consumer awareness and knowledge of sources and health effects poor air quality can create in Erie County, as well as present viable resources available for consumers to participate in and implement in their lives.

To execute a successful, detailed health campaign for the Erie County Department of Health, it is necessary to choose an effective planning model that:

1. Discovers the main problem and solution.
2. Identifies the correct approach.
3. Ensures effective resource use and allocation.
4. Avoids unwanted outcomes.

Planning models provide organization and structure to the planning process to ensure that goals are met. They are flexible and can assist with appropriate implementation of imagination and creativity (Corcoran, 2011).

This campaign has been designed to follow the Nine Step Planning Model:

Step 1: Rationale, Needs and Priorities

Step 2: Aims and Objectives

Step 3: Selection of a Theoretical Model

Step 4: Methods and Design of Method

Step 5: Resources and Budget

Step 6: Evaluation

Step 7: Action Plan

Step 8: Implementation

Step 9: Feedback and Future

The following points explain our rationale behind selecting the Nine Step Planning Model for this campaign.

1. This model is basic, cyclical, and has logical steps. This allows for a clear understanding of the goals and suggested tactics necessary for easy implementation.
2. This planning model will help us focus on the main needs and priorities of the Erie County Department of Health. Our aims and objectives will focus on increasing knowledge and awareness about air quality. In this planning model, the simplicity of the objectives used will help us reach our end goals and administer a successful health campaign.
3. These nine steps will provide an outline and the necessary guidance to execute a detailed plan in an efficient, economical way. This model was examined knowing there are limited resources of staff, time, and funding.
4. The last step in this cyclical model includes feedback and the future. These final steps will provide the Erie County Department of Health with a framework that is manageable for their next aims and objectives once this campaign has been completed. The following sections of this plan will use the Nine Step Planning Model to assist the Erie County Department of Health to increase knowledge and awareness of residents in Erie County about the effects of air quality.

Step 2: Aims and Objectives

The following aims and objectives were formulated to guide this health campaign plan.

Aim: To educate our target audiences about the effects of outdoor air quality.

Objective 1: To increase the knowledge of air quality in 50% of Erie County by November 2020.

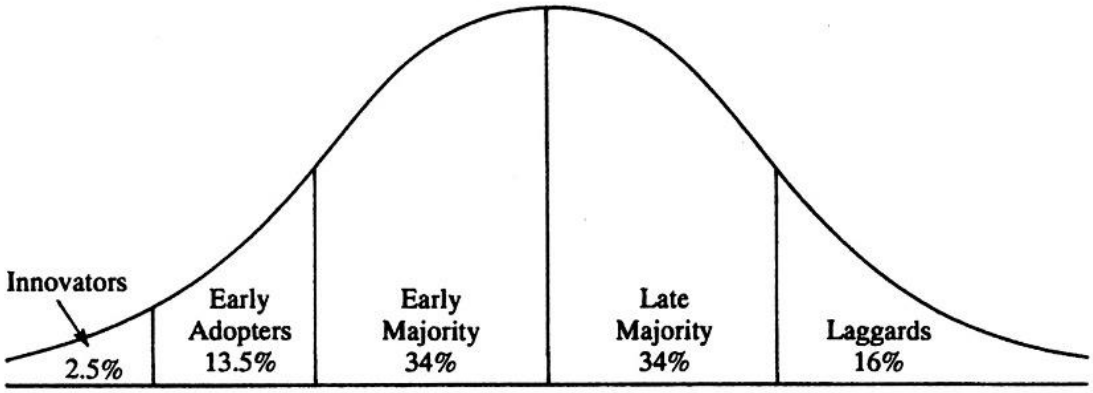
Objective 2: To have 100,000 Erie County residents sign up for a pledge to improve air quality by November 2020.

Step 3: Selection of Theoretical Model

The Diffusion of Innovation Theory (DOI) is a theory of social science, developed in 1962 by E.M. Rogers (LaMorte, 2018). The DOI Theory was developed aiming to explain how an idea can spread through a community, population or social system over time (LaMorte, 2018). The main idea is that there will be diffusion of said idea or behavior (or purchasing of a product) among the people of the social system.

The DOI Theory has a long history, said to have first been studied back in 1903 by a French sociologist named Gabriel Tarde (Kaminski, 2011). It was Tarde who plotted the original S-shaped curve, which would go on to be used in the DOI Theory to describe the rate of adoption among a social system (Kaminski, 2011). Next to add to the DOI Theory were Ryan and Goss, who introduced the categories of adopters that are laid out in the theory we know today, popularized by E.M. Rogers (Kaminski, 2011). Through this theory, Rogers mapped out the process of how innovation can diffuse through different groups of a social system; the different groups consist of the following: innovators, early adopters, early majority, late majority, and laggards.

An image of the DOI Theory with the categories of adopters is shown on the next page:



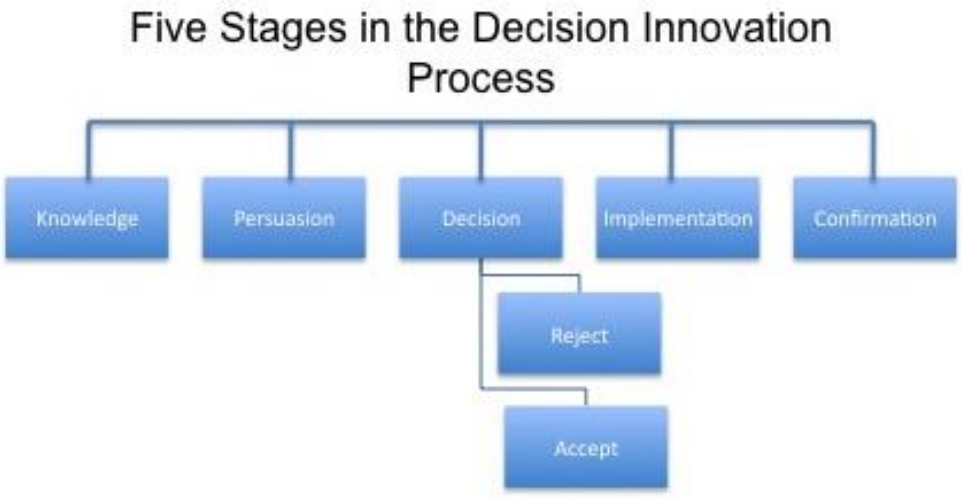
Retrieved from: https://extensionaus.com.au/extension-practice/diffusion-of-innovations-theory-case-studies-and-discussion/

When it comes to adopting a new idea, product, behavior, etc., most of society tends to fall in middle categories (LaMorte, 2018). However, the process of diffusion starts with the innovators. The innovators are the select few who are open, eager and willing to adopt the new idea (Kaminski, 2011). These early innovators set the diffusion into motion by spreading the new idea around to more people. Through promoting the idea by word of mouth and sharing their experiences with it, the innovators help create the "critical mass," consisting of the first three adopter categories (innovators, early adopters and early majority) (Kaminski, 2011). After the innovation is diffused through the critical mass, the "saturation point" is reached, and all that is left is to convince is the late majority and laggards.

The early adopters can be defined as the risk takers or the leaders in a societal system (Kaminski, 2011). Early adopters, or "opinion leaders", know when change can and should be made; therefore, they welcome it (LaMorte, 2018). The early majority, or trend setters, are next to jump on the train; they aren't the ones to lead the society to change but want to avoid being the last to make the change (Kaminski, 2011). They hang back to see how the innovation plays out before they jump on board, once they have evidence that the new idea is worth it (LaMorte, 2018). Giving in to peer pressure next comes the late majority, who are people not too fond of change. The late majority will wait until the innovation has been tried by "the majority" of

society (LaMorte, 2018). Finally, the skeptic laggards will be the last of the population to adopt the new idea, if they even decide to adopt it at all. This group of people are very resistant to change due to their conservative nature and strong ties to tradition—which explains why this group is the most difficult to reach (LaMorte, 2018). The goal of using this theory is to take all five adopter categories into account when promoting a new idea or innovation.

This theory outlines five different stages by which a person adopts a new idea: knowledge/relative awareness, persuasion/interest, decision/evaluation, implementation/trial, and confirmation/adoption. Knowledge or relative awareness is the first stage, where a person is initially exposed to said innovation. The second stage, persuasion or interest, is the point at which the individual becomes interested in the said innovation. The third stage, decision or evaluation, is where the individual decides to try the innovation in his or her present or near future. Implementation or trial, the fourth stage, is when the individual puts the innovation into action. The final stage, confirmation or adoption, is when the individual decides to fully adopt the innovation into their life (Kaminski, 2011). Below is an image illustrating these five stages in the DOI Theory:



Retrieved from: https://en.wikipedia.org/wiki/Diffusion_of_innovations

When promoting an innovation, it is important to consider the factors that will influence the adoption of an innovation. The DOI Theory outlines these five main factors: relative advantage, compatibility, complexity, triability, and observability. Relative advantage is the degree to which the innovation is seen to be better than the current practice, belief, product, idea, etc. (Kaminski, 2011). Compatibility is the degree to which the innovation fits in with current "socio-cultural values, previous ideas, and/or perceived needs," (Kaminski, 2011). Complexity is the degree to which the innovation is easy or difficult to understand (Kaminski, 2011). Triability is the degree to which the innovation can be tried out (Kaminski, 2011). Finally, observability is the degree to which the innovation's results can be observed by others in society (Kaminski, 2011).

One additional, and extremely important, innovation characteristic is re-invention. Re-invention is the degree to which the innovation can be altered over time based on how adoption is going among the society. An innovation that has the characteristic of being subjective to re-invention is more likely to be successful, because it can be altered in response to the needs of the five categories of adopters. More people are likely to adopt an innovation that is seen as "versatile and adaptive" than an innovation strictly set in its ways (Kaminski, 2011).

The Diffusion of Innovation has been used successfully in several related fields, including, but not limited to the following: communication, agriculture, public health, criminal justice, social work, and marketing. For public health, the DOI Theory has been used in important health programs that aim to change the behavior of the related social system (LaMorte, 2018). Recently, the DOI Theory has been utilized by the International Diabetes Federation to "disseminate novel diabetes prevention strategies," (Lien & Jiang, 2016). "In conclusion, DOI theory emphasizes applying social marketing techniques and social networking as

communication channels to rapidly disseminate an innovation. Health professionals should not only provide conventional educational strategies, but also implement innovative strategies for diabetes care considering patients' needs," (Lien & Jiang, 2016). The DOI Theory has also been used in healthcare to study patients' perceptions of personal health records (Emani et al., 2012). "We conclude that the Rogers model of diffusion of innovation fits well for this innovation and offers insights that are both prescriptive and theoretical in nature with respect to PHR adoption and use," (Emani et al., 2012). In relation to environmental issues, the DOI Theory was used by a group for researching "organic farming systems, with the respect of all characteristics and particularities of organic farming," (Tomaš-Simin & Jiang, 2016). The study showed that the theory can be used to help gain a better understanding of the process of adopting innovations of organic processing systems in particular; the study also pointed out the importance of having an innovation that is relatable, adaptable and has that quality of being able to be re-invented if need be (Tomaš-Simin & Jiang, 2016).

The Diffusion of Innovation Theory provides a framework for the adoption of innovation at a societal level, while also paying close attention to the different types of adopters in the society, noting that the needs of adopters at each stage is different and unique. While this theory calls for change on a bigger scale (the society as a whole), it also states and outlines the importance to reach individuals at where they are, understand their needs, and create an innovation that will be feasible to them. Environmental health is a social issue; thus, society needs to be educated and awareness needs to be raised. This theory will be applied to our research and used as a foundation of our campaign tactics and strategies.

Step 4: Method and Design of Method

Secondary Research

According to the U.S. Environmental Protection Agency (EPA, 2018), air pollution occurs through the release of pollutants into the air which are detrimental to human health and the planet. While hazardous chemicals can inadvertently escape into the environment, air pollutants are often intentionally released by industrial facilities, like Erie Coke Corporation, potentially leading to adverse effects on human health and the environment. An air pollutant may cause or contribute to increased mortality or serious illness.

Statistics from the World Health Organization (WHO, 2019) show that 4.2 million deaths per year are a result of exposure to ambient (outdoor) air pollution, and 3.8 million deaths occur every year as a result of household exposure to smoke from dirty cook stoves and fuels. Additionally, the WHO (2019) shows that nine out of 10 people breathe air containing high levels of pollutants. These deaths are a result of the fine particles in polluted air that penetrate deep into the lungs and cardiovascular system, leading to a significant number of noncommunicable diseases (WHO, 2019). The WHO (2019) estimates that air pollution is the cause of one-quarter (24%) of all adult deaths from heart disease, 25% from stroke, 43% from chronic obstructive pulmonary disease and 29% from lung cancer.

With these statistics in mind, the next section will focus on the sources of air pollution, providing a more nuanced understanding of how these air quality-related deaths occur.

Sources of Air Pollution

There are four primary sources of air pollution. These include gaseous pollutants (e.g. SO2, NOx, CO, ozone, volatile organic compounds), persistent organic pollutants (e.g. dioxins), heavy metals (e.g. lead, mercury), and particulate matter.

Gaseous pollutants contribute to a great extent in the composition of variations in the atmosphere and are mainly due to combustion of fossil fuels (Katsouyanni, 2003). Sulfur dioxide has polluted the atmosphere for most of the earth's history.

Carbon monoxide (CO) is an odorless, colorless gas created primarily by incompletely combusted fuels (EPA, 2017a). CO has a high affinity for the hemoglobin in red blood cells, which interferes with oxygen transport to the tissues, and it is also well known for being poisonous and lethal in high concentrations (Earthworks, 2019).

Nitrogen dioxide (NO2) is the main precursor of ozone and, as such, it is a major component of oxidant air pollution (Folinsbee, 1992). The major health end points that have been associated with NO2 are increased incidence of lower respiratory tract infections in children and increased airway responsiveness in asthmatics (Folinsbee, 1992).

Finally, volatile organic compounds (VOCs) are a major class of compounds that fuel combustion, particularly combustion processes for energy production and road transport (EPA, 2017b). This class of compounds includes chemical species of an organic nature, such as benzene. Although most gaseous pollutants are inhaled and mainly affect the respiratory system, they can also induce hematological problems (CO, benzene) and cancer (EPA, 2017b).

Persistent organic pollutants form a toxic group of chemicals. They persist in the environment for long periods of time, and their effects are magnified as they move up through the food chain (biomagnification) (EPA, 2019). These pollutants include pesticides, as well as dioxins, furans and polychlorinated biphenyls (PCB). Generally, the generic term ‘‘dioxins’’ is used to cover polychlorinated dibenzo-dioxin (PCDD) and polychlorinated dibenzo-furan (PCDF), while PCB is referred to as a ‘‘dioxin-like compound’’ and can act similarly in terms of dioxin-type toxicity (Schecter et al., 2006). Dioxins are formed during incomplete combustion

and whenever materials containing chlorine (e.g. plastics) are burned. When emitted into the atmosphere, dioxins tend to deposit on soil and water. However, being water insoluble, they do not contaminate ground water sources. Most dioxins in plants come from air and dust or pesticides.

Heavy metals include basic metal elements such as lead, mercury, cadmium, silver, nickel, vanadium, chromium, and manganese. They are natural components of the earth's crust; they cannot be degraded or destroyed, but they can be transported by air, and they can enter water and human food supplies. In addition, they enter the environment through a wide variety of sources, including combustion, wastewater discharges, and manufacturing facilities (Jarup, 2003). To a lesser extent, they enter human bodies where, as trace elements, they are essential to maintain the normal metabolic reactions. However, at slightly higher concentrations, they can become toxic (Jarup, 2003).

Particulate matter is the generic term used for a type of air pollutants that consist of complex and varying mixtures of suspended particles. These particles vary in size and composition and are produced by a wide variety of activities (Poschl, 2005). Major sources of particulate pollution are factories, power plants, refuse incinerators, motor vehicles, construction activity, fires, and natural windblown dust (Poschl, 2005).

Knowing which pollutants enter the air allows us to have a better understanding of what it means to have poor air quality. After breaking down the composition of these common air pollutants, the importance of maintaining proper air quality levels becomes clear. Still, the severity of health risks associated with those pollutants need further review.

Human Health Effects of Air Pollution

Air pollution has the potential to damage the health of multiple body systems. Depending on the level of exposure and the type of pollutant inhaled, these effects can vary, ranging from simple symptoms, like coughing and irritation of the respiratory tract, to acute conditions, like asthma and chronic lung diseases (Ghorani-Azam, Riahi-Zanjani, & Balali-Mood, 2016). Skin problems and irritations can develop due to prolonged exposure to several air pollutants, and a variety of cancer forms may develop after inhaling air contaminants (Ghorani-Azam, Riahi-Zanjani, & Balali-Mood, 2016).

Respiratory System

Numerous studies support that all types of air pollution, in high concentrations, can affect airways (Balmes et al., 1987; Kagawa, 1985). Similar effects are also observed with long-term exposure to lower pollutant concentrations. Symptoms such as nose and throat irritation, followed by bronchoconstriction and dyspnea, especially in asthmatic individuals, are usually experienced after exposure to increased levels of sulfur dioxide, nitrogen oxides, and certain heavy metals such as arsenic, nickel or vanadium (Balmes et al., 1987; Kagawa, 1985).

In addition, particulate matter that penetrates the alveolar epithelium and ozone can initiate lung inflammation (Ghio & Huang, 2004; Uysal & Schapira, 2003). In patients with lung lesions or lung diseases, pollutant-initiated inflammation will worsen their condition. Moreover, air pollutants, such as nitrogen oxides, increase susceptibility to respiratory infections (Chauhan et al., 1998). Finally, chronic exposure to ozone and certain heavy metals reduces lung function (Rastogi et al., 1991; Tager et al., 2005), with the latter also responsible for asthma, emphysema, and lung cancer (Kuo et al., 2006; Nawrot et al., 2006). Emphysema-like lesions have also been observed in mice exposed to nitrogen dioxide (Wegman et al., 2005).

Cardiovascular System

After it is inhaled, carbon monoxide binds to hemoglobin, modifying its conformation and reducing its capacity to transfer oxygen (Badman & Jaffe, 1996). This reduced oxygen can affect the function of different organs (and especially high oxygen consuming organs such as the brain and the heart), resulting in impaired concentration, slow reflexes, and confusion. Apart from lung inflammation, systemic inflammatory changes are induced by particulate matter which affects blood coagulation (Riediker et al., 2004). Air pollution that induces lung irritation and changes in blood clotting can obstruct cardiac blood vessels, leading to angina or even to myocardial infraction (Vermylen et al., 2005). Symptoms such as tachycardia, increased blood pressure and anemia due to an inhibitory effect on hematopoiesis have been observed due to heavy metal pollution, specifically from mercury, nickel, and arsenic (Huang & Ghio, 2006). Finally, epidemiologic studies have linked dioxin exposure to increased mortality caused by ischemic heart disease (Dalton et al., 2001).

Erie County Air Quality

"Our Nation's Air" is an annual report released by the EPA to set air quality standards and provide an overview of current air quality trends throughout the nation. The 2018 report is appended. The 2019 report is incomplete; however, the carbon monoxide value, which was the only item available, meets quality standards. The air quality in Erie County meets the following air quality standards:

EPA Air Quality Standards

Carbon monoxide: 35 ppm (1-hour), 9 ppm (8-hour)

Nitrogen dioxide: 100 ppb (1-hour), 53 ppb (annual)

Ozone: 0.12 ppm (1-hour), 0.070 ppm (8-hour)

Sulfur dioxide: 75 ppb (1-hour), 140 ppb (24-hour), 30 ppb (annual)

PM2.5: 35 ug/m3 (24-hour), 12.0 ug/m3 (annual)

PM10: 150 ug/m3 (24-hour)

Lead: 0.15 ug/m3 (3-month avg)

Factors Affecting Consumer Decision-Making

In designing campaigns in public health, it is important to note factors that affect decision-making behaviors. A thorough understanding of consumer needs and concerns related to air pollution and health can inform governmental approaches and policies aimed at addressing the problem (Chin et al, 2019). However, Peebles (2018) emphasized that ending pollution demands a change in attitude and individual mindset. Although governments need to take a leading role to stop pollution, Peebles argues that individuals "need to change the way we think and how we live. It is imperative we consume less and that decisions regarding purchases should be made firstly with environmental considerations in mind" (2018). Thus, research on consumer knowledge, awareness, and attitude is vital in composing an effective campaign plan.

Furthermore, Chin et al. (2019) conducted a study using a cross-sectional survey of people living in the Klang Valley and Iskandar conurbations to examine urban Malaysians' perception, awareness and opinions of air pollution. The survey collected information on sociodemographic factors, on the public perception of air quality and the causes of air pollution, on public awareness of air pollution and its related impacts, and on attitudes towards environmental protection. Overall, most respondents were aware that motor vehicles represent the primary pollution source, yet private transport was still the preferred method of transportation.

Although a generally positive approach toward environmental protection emerged from the study, participants more strongly agreed with protection actions that do not involve individual effort (Chin et al., 2019). Certain segments of the sample (people owning more than three vehicles per household and those with relatives who suffered from respiratory diseases) were significantly more willing to personally pay for environmental protection compared to others. Female respondents had significantly lower awareness than males (Chin et al., 2019).

Additionally, factors such as age, income, employment sector, education level, income and parenthood had no significant effect on awareness level (Chin et al., 2019). However, the authors noted inconsistency with findings of other studies. In addition, the public tended to perceive a low level of control over environmental problems. This perception may discourage affected populations from becoming part of the solution (Chin et al., 2019).

The implications of this research point to the need for global action. Spreading awareness of air pollution and air quality will be the central focus of this campaign, especially with regards to its health risks, as well as strategies for increasing the perception of behavioral control.

Market Research

Due to the ubiquitous nature of technology in our society, the functionality and presentation of an organization's website is crucial to its success. At the very least, an organization's website should be aesthetically pleasing, user friendly, and up to date with relevant, accurate information. The website for the Erie County Department of Health (ECDH) is lacking all three of those areas.

Starting at the surface level, the website's design lacks an "eye catching" quality that has proven to be vital in successful marketing. The website is very bland and lacks the creativity necessary to catch and keep the attention of the public. More specifically, the layout is one solid

color and displays a large amount of uninterrupted text. A more attractive and interactive website would captivate the user's focus and encourage exploration of the website. Additionally, it would be beneficial to incorporate graphics and images to provide a visual stimulus alongside the text.

A major flaw in the ECDH website is that it appears to be out of date. Some of the most significantly out of date information on the website can be found under the Health Promotion tab, where advertising for the Let's Move Outside program can be found. The page shows that the program ended in October 2015, yet the website promotes it as being in session. Along similar lines, the website lists all the local walks and runs happening in Erie County, the purpose of which is to push the community to sign up and participate. All the "upcoming" walks and runs listed were from 2017. There is no list of current or future walks or runs.

For the purposes of this research, it is important to note that the ECDH website has little emphasis on air quality. In fact, it is difficult to find any mention of air quality beyond its inclusion in certain funding applications. A link to the ECDH Facebook is available on the homepage, but the link is broken. While there is a semi-active Facebook page with positive reviews mentioning the breadth of information available, no posts containing the words "air quality" have been made. When searching for air quality information in Erie County, PA, most of the results come from the PA Department of Environmental Protection (DEP). Furthermore, the website for the ECDH links to the DEP for details on the state-wide air quality plan. After examination, it seems the ECDH has left much of the air quality promotion to the DEP and other governmental organizations, likely due to a general lack of resources.

In order to better understand the methods used by the ECDH and how they can be improved, the marketing tactics of health departments in Ashtabula County, OH, and Allegheny County, PA, were also evaluated and used for comparison.

Poor air quality ratings in Ashtabula County have served as motivation to improve and bring awareness to the issue. As a result, the website for the Ashtabula County Health Department in Ohio has a strong foundation for improving air quality and disseminating information. The county has even had Air Quality Advisory days in the past, recommending that sensitive populations (older people, kids, weakened immune systems, respiratory illnesses, etc.) be cautious and monitor their outdoor activity due to very poor air quality.

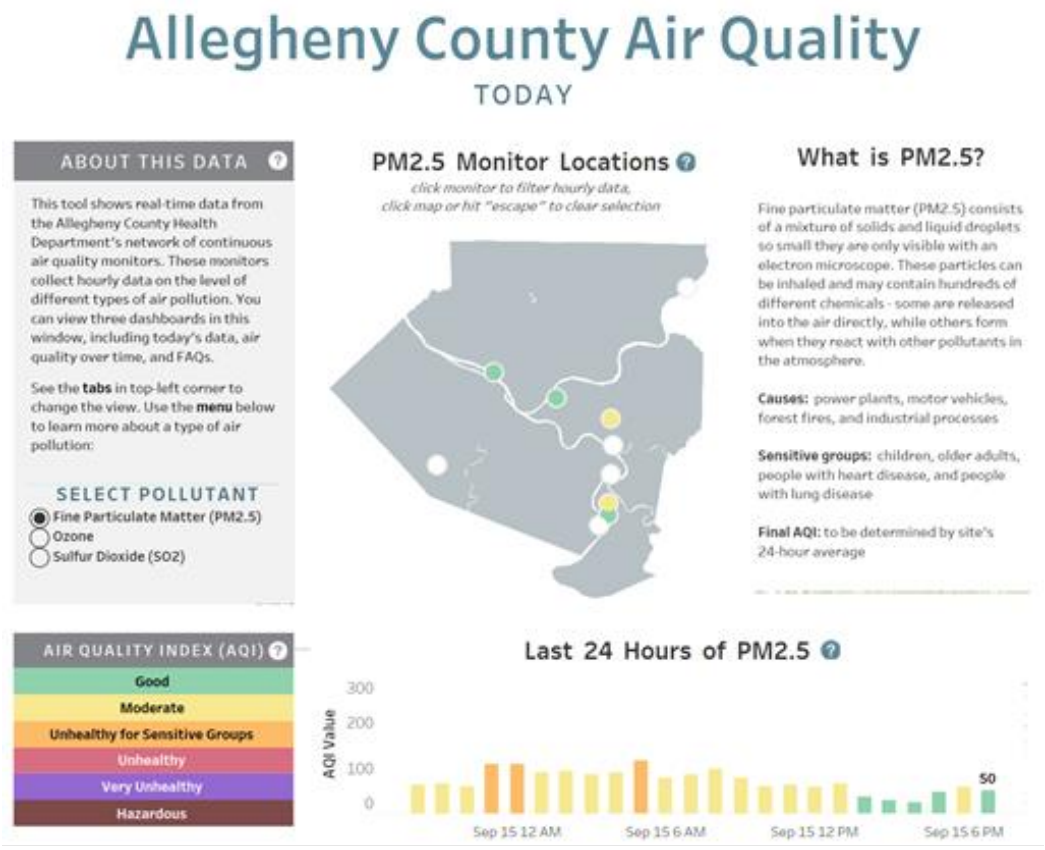
The Ashtabula County Health Department provides easy access to information concerning air quality, and the website includes multiple pages devoted to this information, including Planning, Trends, and Advisories, as well as links to reports and data on current air quality figures. The website presents the information in a simple, visually stimulating layout and details each individual effort being made to address air quality.

Notably, the site describes the Commuter Choice Award, which is used as an incentive for employers to facilitate and encourage commuters to seek out alternative transportation and, subsequently, improve air quality through the reduction of harmful emissions. There are also separate programs to encourage ridesharing, anti-idling training, signs, etc. Ultimately, implementing something like the Ashtabula County Commuter Choice Award in Erie County would be ideal, but it is important to note that the award is sponsored by a regional, government-backed organization that likely has far more resources than the ECDH.

Another useful comparison comes from the Allegheny County Health Department (ACHD) in Pennsylvania. The county's website is engaging and compelling, allowing users to explore different organizations and county concerns through videos, links, brochures, fact sheets, and more. Specifically, the Health Department page uses bright, captivating colors, along with interesting and relatable images and simple language that is easily understood.

The ACHD website contains a wide variety of information. One feature that stands out is the page on health-related news in the county where you can read all health-related articles from any given year. In contrast, the ECDH website lacked easily accessible health-related news and had nothing from the current year. While the ECDH website is reliant on formatting decided by Erie County, additional features to note from the ACHD website include revolving tabs on the home page that show top projects the department is currently working on, the ability to create an account on the website and personalize the experience, and the option to save a page to your account at the click of a button. These features make the website experience more personal for the user, drawing in the community in and encouraging engagement.

There is a devoted air quality page on the ACHD website, which includes eye catching visuals, easy to read graphs, and a tab for frequently asked questions on air quality. Air quality is a major topic explored by Allegheny County, which counts Pittsburgh as its largest city. The health department's website informs the public of current air quality levels and forecasts future conditions, allowing county residents to be involved and informed about the air surrounding them. An interactive map shows local air quality in real time and allows you to see which pollutants are causing the problem in each area. An example of this map is shown on the following page:



Retrieved from: www.alleghenycounty.us/healthdepartment

The ACHD website also provides a list of simple activities residents can participate in to reduce their contribution to poor air quality, information on how to become involved in the organization, and details on fun activities for children.

As for social media, the ACHD primarily utilizes Facebook to inform and engage the public on important health topics within the county. This helps to disseminate information in a clear, concise manner, while using graphics and simple language to attract audiences and facilitate understanding. Furthermore, the posts provide additional links for users to gather more information about certain health topics, as well as links where users can submit comments to be discussed at a public meeting. The photos on the following page are examples of Facebook posts created by the department:

Retrieved from: www.alleghenycounty.us/healthdepartment

With comparisons to Ashtabula County and Allegheny County in mind, there are several ways that the ECDH could improve their efforts to inform the community. Information that should be prioritized includes the definition of air quality, the causes of poor air quality and opportunities for improvement, and how poor air quality can directly impact health. The site should also highlight relevant news and events, like recent and long-standing issues between Erie Coke Corporation and the PA DEP regarding the company's impact on air quality throughout the area. The website and Facebook page should be updated regularly to include more information (or links to more information at the very least) that is easier to access. Graphics and videos are especially effective in targeting the digital community, but leaflets or posters placed in relevant spaces would be effective in reaching people who do not consume their information digitally.

Primary Research

As part of our campaign to analyze what Erie County residents know about air quality, we sent out a survey with 33 questions, six of which were demographic questions. A total of 95

people responded. Of those who responded, 35.2% were male and 62.5% were female. However, 2.3% of participants opted not to respond to the question. Additionally, 72.6% indicated their ethnicity as white, 11.6% identified as black and 6.4% indicated Asian, Hispanic, or other, while 9.4% opted not to respond. Our primary respondents were white females. Our survey also asked for respondents to provide their age. We had responses from individuals between 18 and 89, with 18 being the minimum age to participate. The average age of participants was 34.83. We also analyzed education level, residency in Erie County, and income level. The following charts yield the results from the survey.

Data Analysis

Our data reveals that many respondents (73.7%) have graduated from higher education with a degree, indicating that our respondents are well-educated individuals. Regarding the remaining individuals, 11.6% responded with "some college," which indicates that they are either currently enrolled or did not complete higher education. An additional 8.4% of respondents opted not to respond.

Education		
	Frequency	Percent
Some High School	1	1.1
High School Diploma	5	5.3
Some College	11	11.6
Associate Degree	3	3.2
Bachelor's Degree	32	33.7
Master's Degree	25	26.3
Doctoral or Professional Degree	10	10.5

In addition to education level, our research wanted to examine where in Erie County our respondents resided in. These results revealed more than half of our participants (55.8%) were from Erie. Millcreek followed with 10.5% indicating the township as their home, with Fairview trailing close behind with 9.5%. Our primary research also reach smaller townships within Erie County. Lake City, Albion and Corry provided results of 1.1% of respondents residing in these townships. Respondents who indicated "other" were from Union City and East Springfield.

Residence		
	Frequency	Percent
Erie	53	55.8
Millcreek	10	10.5
Harborcreek	6	6.3
Lawrence Park	2	2.1
Fairview	9	9.5
Lake City	1	1.1
Albion	1	1.1
Edinboro	5	5.3
Corry	1	1.1
Wattsburg	2	2.1
Other	2	2.1

Only 83 out of the 95 respondents chose to provide their annual income. The results yielded that nearly half of our respondents (40%) earned a yearly income of $49,999 or less. This large majority could be the result of respondent education levels, particularly from those who are still enrolled or have recently graduated. Another 27.4% of respondents earned $100,000 or more. While our data may be skewed due to college-aged participants, these divisions are like

those of Erie County where 51% of the population make $50,000 or less; 30% make $50,000-$100,000; 16% make $100,000-$200,000; and 3% make $200,000 or more (Census Reporter, 2019).

Income		
	Frequency	Percent
$49,999 or less	38	40
$50,000 to $99.999	26	27.4
$100,000 to $149,000	9	9.5
$150,000 to $199,999	6	6.3
$200,000 or more	4	4.2

Our remaining survey questions were designed to help us determine what stage of the decision process in the Diffusion of Innovation Theory the residents are at. As previously stated, there are five stages in the theory: knowledge, persuasion, decision, implementation and confirmation. We had several questions in the survey pertaining to each stage. The chart below indicates the questions asked for each stage, as well as the results for reliability estimates, means, and standard deviations.

5 Stages of Diffusion of Innovation Theory Survey Question			
	Questions	Reliability	Mean (SD)
Knowledge	• I am knowledgeable about outdoor air quality. • I am knowledgeable about air pollution. • I am educated about what negatively affects outdoor air quality. • I am educated about what positively affects outdoor air quality.	α=.91	3.10(.96)
Persuasion	• I am interested in learning more about outdoor air quality. • I am interested in learning more about air pollution and the environment. • I think about air quality often.	α=.89	3.46(.95)
Decision	• I am concerned about the effects the environment has on my health. • I think that air pollution has become more serious in the recent years. • I think that climate change has become more serious in recent years. • I am concerned about outdoor air quality. • I am concerned about air pollution.	α=.88	3.93(.83)

Implementation	• I am able to help in keeping outdoor air quality safe. • Improving outdoor air quality is something that I can help do. • I am willing to do my part to improve outdoor air quality. • I have resources to help me improve outdoor air quality.	α=.72	3.55(.67)
Confirmation	• I partake in activities that could negatively affect outdoor air quality (reverse coded). • I partake in activities that could positively affect outdoor air quality. • I do my part to improve outdoor air quality. • My behaviors help to positively impact outdoor air quality and address air pollution.	α=.80	3.4(.56)

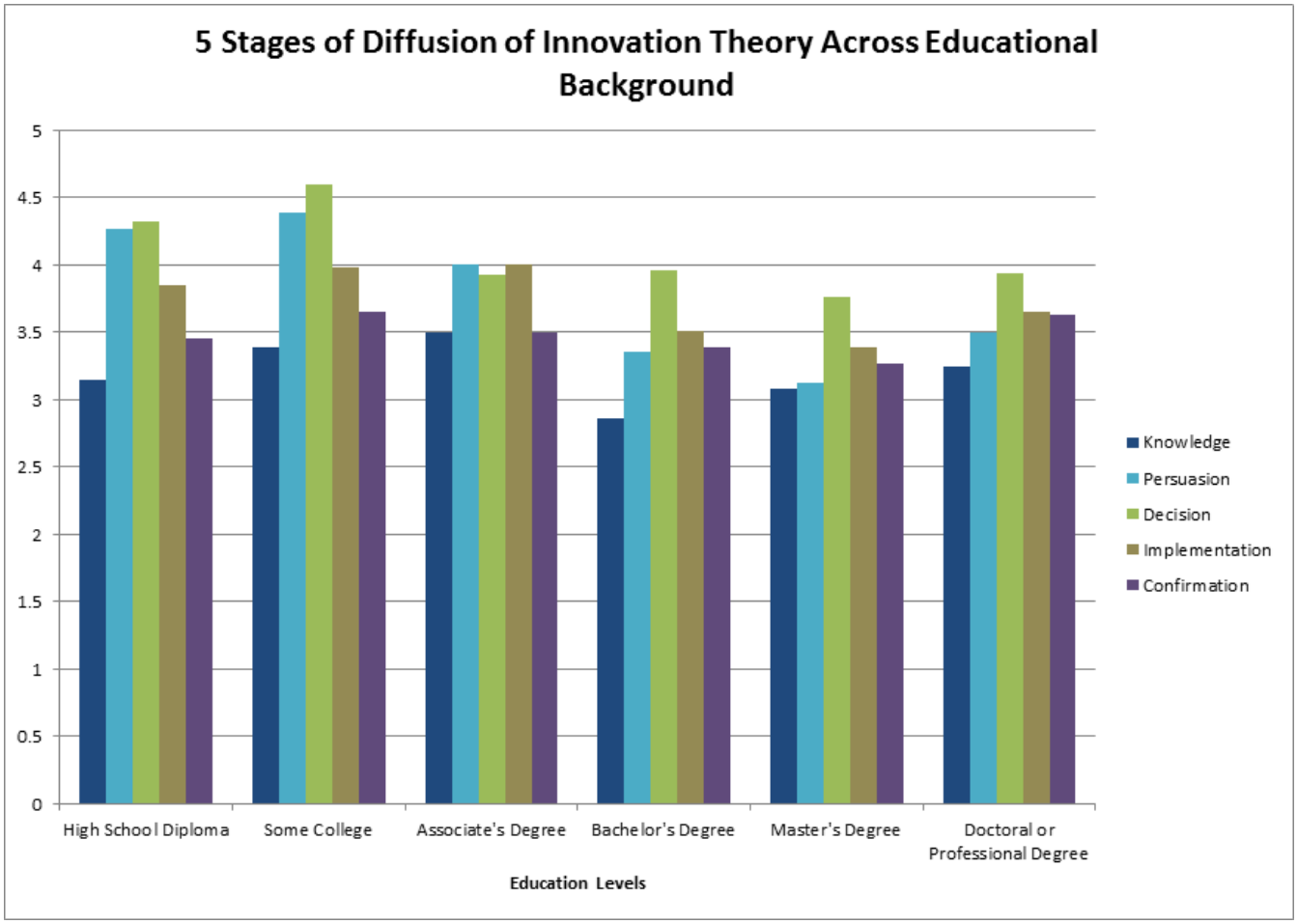
The questions noted above were checked for reliability and averaged into a scale for each variable in the diffusion model. This allowed us to test potential differences among variables for each of the demographic groups we were interested in. It also allowed us to predict what factors lead individuals to partake in activities that directly benefit air quality.

Results

To determine if there were differences in how various demographic groups reported their responses to questions about the diffusion of information related to outdoor air quality and air pollution, a series of ANOVA tests were run. In general, no differences were found across

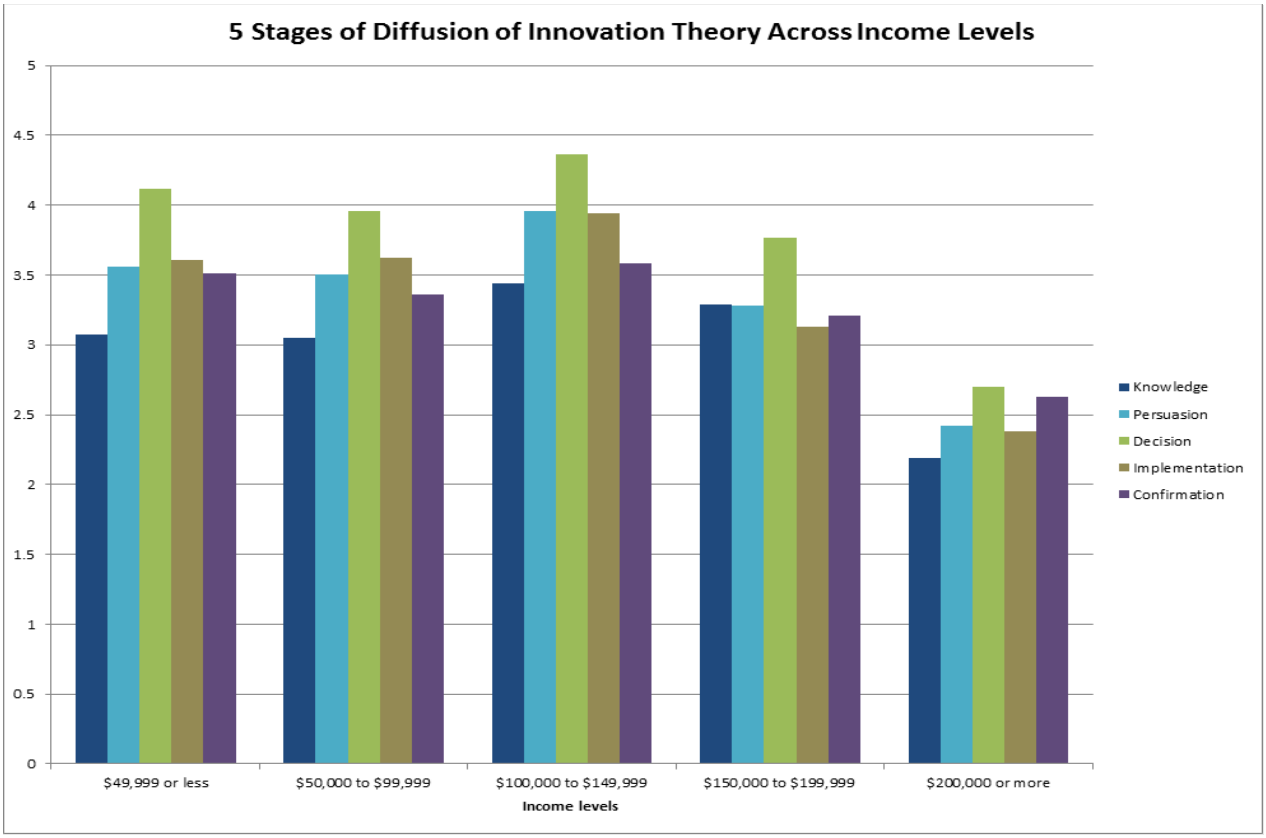
genders on knowledge, persuasion, decision, confirmation, or implementation. However, differences were found across income and education.

As shown in the graph below, persuasion was one area in which responses significantly differed. Specifically, those with lower levels of education were more likely to suggest interest, and therefore the ability to be persuaded, when it comes to outdoor air quality ($p<.001$). When we compare this to those with college degrees or higher, we see that those individuals are less likely to indicate interest in air quality. There were no significant differences across other variables measured.



The same results were found regarding income levels. We can see that across income levels measured, persuasion is higher among those who report lower levels of income and lower

among those reporting the highest incomes ($p < .028$). This suggests that we can target those individuals with lower incomes in our persuasion efforts throughout this campaign as they may be more receptive to the message. In addition, we see significant differences in decision responses ($p < .008$) and implementation ($p < .004$). Again, these responses were higher in our lower education respondents as compared to those with higher levels of education in general.



When considering these results, we should think about why we found the differences that we did. Our sample may be skewed toward college-age respondents. When looking at the income level for this demographic, they are found within the lower range, which is expected since they are likely to be in college and do not have a steady income. The education levels also indicate some form of consensus among their respective participants to formulate the bell curve ideal for the Diffusion of Innovation Theory. This data will be beneficial to the current campaign, especially with the majority, which is on the cusp of the decision-making stage.

As outlined in the Diffusion of Innovation Theory, confirmation is the last stage an individual goes through in adopting a new behavior. A regression analysis was conducted to determine what factors influence the likelihood that an individual adopts a behavior. Confirmation was used as the dependent variable, and the remaining elements of the diffusion process, as well as several demographic variables, were used as potential predictors. Results of the analysis showed that knowledge and implementation were significant predictors of confirmation. None of the demographic variables predicted whether someone ultimately changed their behavior, as measured by the confirmation variable. Results of the regression analysis are found in the chart.

	Confirmation	
Controls	β	β
Age	-.41**	-.20
Gender	-.04	-.06
Ethnicity	-.22*	-.12
Income	.01	.02
Education	-.10	-.09
Residence	-.12	-.05
Predictors		
Knowledge		.27*
Persuasion		-.11
Decision		.11
Implementation		.35*
Adjusted R^2	.22	.46

Note: *= p<.05, **= p<.01.

These results suggest that those with higher knowledge and willingness to change their behaviors are more likely to suggest that they partake in activities of behaviors to improve air quality. This is useful to know in that we can look to increase knowledge or self-efficacy to encourage individuals to take part in behaviors that will help the environment.

The persuasion stage is high across all participants, which aligns with the respondents' interest in learning more and becoming more aware about how they can adapt their behaviors to improve outdoor air quality. We were not expecting the persuasion stage to be as high as it was. However, the results did confirm our prediction that the knowledge and confirmation stages would be low based on the low ends of the bell curve in the Diffusion of Innovation Theory. Since people aren't exposed to messages about air quality, they aren't knowledgeable about our campaign topic, which means that we can primarily focus on increasing knowledge as part of our campaign. As for the confirmation stage, respondents don't recognize the activities they partake in can affect air quality, either negatively or positively. Another goal we can strive to achieve through our campaign is to not only make individuals more knowledgeable about air quality but also to inform them of options to improve air quality so that they can change their behaviors to improve and maintain good air quality in Erie County.

Additionally, it is important to identify that all our respondents were neutral (3) when deciding and implementing behaviors to contribute to maintaining and improving outdoor air quality. This provides us with the understanding that all participants were neutral or inclined to take some action. Using education and persuasion to address outdoor air quality, we can potentially sway our target audience to act and change behaviors, especially knowing where people are placed on the Diffusion of Innovation model.

From our research, two questions are proposed:

1. Why does air quality matter?
2. Can I adapt my behaviors to contribute to improved air quality in Erie County?

These questions will serve as the premise of our campaign, focusing on levels of knowledge/awareness and self-efficacy and indicating the needs of our target audience. We will use strategies and tactics that will best reach college students, parents, and environmentally conscious populations. Overall, our primary research results will assist us in creating a campaign that will target our primary audience, as well as provide an understanding of attitudes and behaviors regarding air quality in Erie County.

Target Audience

Three target audiences were identified for increasing knowledge, awareness and education about outdoor air quality. These audiences include the environmentally conscious populations, parents, and college students. Each audience has varying perspectives, knowledge, interpretations and connection to outdoor air quality.

Environmentally Conscious

Meet Wendy (Conservationist, Gen Y):

Age: *33*

Description: *Conservationist, has a bachelor's degree, single, lives in downtown Erie, and works as a local landscaper*

Main concerns: *Protecting and maintaining a healthy environment in Erie*

Preferred sources of information: *Facebook, Google, word of mouth from family and friends*

Being an environmentally conscious individual can be defined in many ways. Merriam-Webster defines eco-conscious as "marked by or showing concern for the environment" (2019). On the other hand, O'Donnel (2018) expands on the previous definition to state that being an environmentally conscious individual means going and living green, being natural and nature-friendly, and being environmentally friendly and cautious. These individuals are leaders within our communities that advocate to create a healthy environment for our current and future generations. These individuals want to protect and maintain the environment for not only plants and animal health but also human health. In comparison with the Diffusion of Innovation Theory, environmentally conscious individuals would fall within the innovators or early adopters' category of the bell-curve. As advocates, these individuals often receive their information through word-of-mouth. According to Nielsen, 92% of people trust recommendations from friends and family over any other type of advertising (Nielsen, 2012). It is also important to note that 43% of Americans get their news from Facebook (Cooper, 2019). Thus, environmentally conscious individuals use this platform to spread awareness and knowledge about the environment.

Parents

Meet Jim (Father, Gen X) and Karen (Mother, Gen X):

Age: *44 and 42*

Description: *Married, parents of three kids (13 year old twins and an 8 year old). They live in a ranch-style home in Fairview. Jim works at Erie Insurance as a financial advisor. Karen is a teacher at Fairview Elementary School.*

Main concerns: *Providing for their family, children's health and well-being, being aware and engaged in their community*

Preferred sources of information: *Local news on radio and television, Google, Facebook*

This target audience focuses on Generation X parents. According to the Pennsylvania Department of Labor & Industry, 24.2% of the Erie County population is between the ages of 25 and 44 (2019). Parents of elementary and secondary-aged children are found within this age group. Additionally, 21.8% of the Erie County population that is aged 17 and under (Pennsylvania Department of Labor & Industry, 2019). To reach the parents, we can utilize in-school discussions, events and marketing materials. There are 13 school districts in Erie County (School Districts in Erie County, 2019). Parents are also active on social media, specifically Facebook. According to Pew Research, parents are particularly active on Facebook and LinkedIn compared to non-parents (Duggan, 2017). Further research shows that females between the age of 25 and 44 compose 22.6% of those who use Facebook; meanwhile, 20.9% of males between the age 25 and 44 use Facebook (NapoleonCat, "Statistica", 2019). Both males and females within this age demographic have the largest presence on Facebook compared to other ages.

Parents of children with air pollution-related diseases, such as asthma, and heart disease are more knowledgeable and aware of air pollution effects, since asthmatic children are among the most targeted at-risk groups when it comes to air pollution. The top three respiratory conditions associated with poor air quality among children were cough (90.5%), upper respiratory infection (72.9%), and bronchitis (47.2%) (Pædiatrica, 2006). Parents are concerned for the well-being and health of their children; thus, parents are more apt to want to become more knowledge and involved to protect their children.

College Students

Meet Lauren and Brian (College students, Gen Z):

Age: *22 and 21*

Description: *Lauren is a senior at Mercyhurst University studying business administration and Brian is a junior at Gannon University studying occupational therapy. They are friends and both live in an apartment building on State Street in Erie.*

Main concerns: *Going to class, studying hard, extracurricular activities, paying rent, environment*

Preferred sources of information: *Facebook, Twitter, Instagram, YouTube, bulletin boards around campus, campus newspaper*

As Erie County is home to various colleges, universities and trade schools, college-age students (ages 18 to 24) construct 10.5% of Erie County residents (Pennsylvania Department of Labor & Industry, 2019). College students are busy individuals, juggling academics, work, social lives, extracurricular activities, etc. A recent study showed that 62.4% of college students are involved in extracurricular activities on campus (American Academy of Sleep Medicine, 2017). College students are reached through social media and on-campus advertising regarding information about their community. These mediums create a sense of community, which allows college students to have the opportunity to have their voices heard. Additionally, a research study revealed that 72-80% of college students, on average, read their student newspaper (Daly, 2013). Thus, for larger colleges, a higher sum of students between ages 17 and 23 consume information through this method.

Research suggests an average of 73.8% of students know the effects of air pollution on their health (Adel Ghorani-Azam, 2016). Results showed that most students are concerned about

the environment for the children; however, they are less concerned with the asthma incidences that are caused by air pollution (Adel Ghorani-Azam, 2016). Raising awareness about air pollution is one of the most pragmatic ways that can effectively prevent and mitigate the effects of air pollution. Therefore, campaigns in universities and schools can be used to improve the level of awareness among students (Adel Ghorani-Azam, 2016).

Step 5: Budget and Action Plan

The action plan and budget were constructed with limited staff availability, minimal resources and budget in mind when considering the cost and execution of tactics.

2019 – 2020 Calendar

Date	Tactic	Cost
November	Email professors in the sciences about Breathe Easy College Pledge Competition	Cost of labor
	Create and provide posters to schools in Erie County about the pledge competition	Cost of labor, printing materials
December	Kickoff/countdown to Breathe Easy pledge competition for schools in Erie County	Cost of labor, printing materials
	Order/ Print stickers for pledgees	Cost of labor, printing materials
	Social Media- Air Quality Tip Tuesday (Every Tuesday)	Cost of labor
	Social Media- Video testimonials posted twice a month	Cost of labor

January	Social Media- Air Quality Tip Tuesday (Every Tuesday)	Cost of labor
	Add Pledge Page to Website	Cost of labor
	Distribute stickers	Cost of labor
	Social Media- Video testimonials posted twice a month	Cost of labor
February	Breathe Easy College Pledge Competition begins	Cost of labor to track progress of competition
	Social Media- Air Quality Tip Tuesday (Every Tuesday)	Cost of labor
	Social Media- Video testimonials posted twice a month	Cost of labor
	Create and provide flyers for teachers to give to students with air quality facts	Cost of printing materials
	Promote Poster Contest to local school districts	Cost of promotion materials for poster contest
March	Social Media- Air Quality Tip Tuesday (Every Tuesday)	Cost of labor
	Begin Poster/Art Contest with Local Schools	Supply prizes for contest
	Announce Winner of Contest at the end of the month	Cost of labor
	Social Media- Video testimonials posted twice a month	Cost of labor

April	Air Quality Awareness Week Walk	Supplies, promotional materials for walk
	Provide Air Quality Week Walk Promotional Posters/Flyers to hang in local coffee shops	Cost of printing and labor
	Keynote Speakers – local professors, national activists	Cost of speakers' time, cost of transportation
	Create and provide flyers for teachers to give to students with air quality facts	Cost of printing materials
	Air Quality Awareness Billboard Ad	Monthly cost of ad
	Radio PSA	Cost of labor to reach out to local radio stations
	Social Media- Air Quality Tip Tuesday (Every Tuesday)	Cost of labor
	Social Media- Video testimonials posted twice a month	Cost of labor
May	Billboard ad	Cost of billboard ad
	Create and provide a press release and video news release for local media outlets for Clean Air Day	Cost of labor to create video and distribute to outlets
	Social Media- Air Quality Tip Tuesday (Every Tuesday)	Cost of labor
	Social Media- Video testimonials posted twice a month	Cost of labor

June	Billboard Ad	Cost of ad
	TV/Media PSA	Cost of labor to reach out to media outlets
	Tree planting event	Supplies to plant trees
	Air video on local media outlets encouraging biking, walking or carpooling for Clean Air Day (June 20)	Cost of media coverage
	Social Media- Air Quality Tip Tuesday (Every Tuesday)	Cost of labor
	Social Media- Video testimonials posted twice a month	Cost of labor
July	Print ads for local newspapers, magazines, etc. (In Millcreek, Lake Erie Lifestyle)	Cost of labor to create ad, cost of ad space
	Social Media- Air Quality Tip Tuesday (Every Tuesday)	Cost of labor
	Social Media- Video testimonials posted twice a month	Cost of labor
August	Social Media- Air Quality Tip Tuesday (Every Tuesday)	Cost of labor
	Social Media- Video testimonials posted twice a month	Cost of labor
	Table at Celebrate Erie	Cost of tabling, materials to hand out

September	Social Media- Air Quality Tip Tuesday (Every Tuesday) Create and provide flyers for teachers to give to students with air quality facts Social Media- Video testimonials posted twice a month	Cost of labor Cost of printing materials Cost of labor
October	Social Media- Air Quality Tip Tuesday (Every Tuesday) Social Media- Video testimonials posted twice a month Table at Fall Fest in Asbury Woods	Cost of labor Cost of labor Cost of tabling, materials to hand out
November	Social Media- Air Quality Tip Tuesday (Every Tuesday) Social Media- Video testimonials posted twice a month Print ads for local newspapers, magazines, etc. (In Millcreek, Lake Erie Lifestyle)	Cost of labor Cost of labor Cost of labor to create ad, cost of ad space

Step 6: Evaluation

Evaluation is important to know that the overall goal to educate our target audiences on the effects of air quality. The strategies, aims, objectives and tactics were carried out successfully. The criteria and tools are as follows:

Criteria One: To increase the knowledge of air quality in 50% of the target audience by November 2020.

Tool One: Track the number of educational materials on air quality that was distributed and utilized by schools in Erie County.

Tool Two: Track and monitor social media analytics using engagement to determine the number of unique viewers.

Tool Three: Survey residents of Erie County to determine if knowledge about air quality increased at the end of the campaign.

Criteria Two: To have 100,000 Erie County residents sign up for a pledge to improve air quality by November 2020.

Tool One: Track and review the number of pledging on air quality.

Step 7: Action Plan

Objective 1: To increase the knowledge of air quality in 50% of Erie County by November 2020.

- **Strategy 1:** To disperse educational materials about air quality to schools in Erie County.
  - **Tactic 1:** To host a coloring contest about air quality with different age groups. The coloring contest would provide an opportunity to reach younger demographics. The contest would be a fun, interactive activity for students that would simultaneously educate them on outdoor air quality.
  - **Tactic 2:** To provide flyers for teachers to hand out to students with air quality facts and suggestions several times throughout the school year (January, April, September). January would be most beneficial when students return from Christmas break, April before the students leave for summer, and September for when the students return to school.

- **Tactic 3:** To utilize Air Quality Awareness Week (April 27, 2020 to May 1, 2020) by inviting guest speakers to visit schools (and stream the speakers on Facebook Live to include parents if they can't attend) and provide a list of activities for schools to do.

- **Strategy 2:** To inform our audiences on the dangers of air pollution.
  - **Tactic 1:** To organize a healthy air walk with keynote speakers during Air Quality Awareness Week. These speakers can be local or nationally involved in air quality, such as professors from local colleges, professionals from Presque Isle, or members of the EPA. The walk would bring together individuals from Erie County to walk together to raise awareness about outdoor air quality as well as have materials available before and after the walk for those who want more information.
  - **Tactic 2:** To organize a tree planting event. The tree planting event would provide another opportunity to raise awareness about outdoor air quality. Planting would allow our participants to feel like they are involved and contributing to changing air quality in Erie County.
- **Strategy 3:** To create and use promotional materials to promote air quality events and messages.
  - **Tactic 1:** To create and share social media content that utilizes fear appeals (videos, posts) and post to different platforms (Facebook, Twitter, Instagram). Posting on all three platforms would allow us to reach different members of our target audience. Social media also allows us to reach a broader audience outside of our primary target audience.

- ◊ **Tactic 2:** To create a PSA for local radio stations. A PSA would help reach individuals in Erie County who may not frequently use social media but may be interested in improving air quality in Erie County. We would send the PSA to a variety of local stations to reach more listeners.
- ◊ **Tactic 3:** To create print ads for college, local and county newspapers, magazines, etc. (In Millcreek, Lake Erie Lifestyle). The ads would promote Air Quality Awareness Week, the healthy air walk, tree planting event, and our pledge competition.
- ◊ **Tactic 4:** To create flyers/posters to place in local businesses, such as restaurants, coffee shops, or doctors' offices. The flyers would have a QR code to notify a passerby where they can join the pledge or find more information about air quality in Erie County.

Objective 2: To have 100,000 Erie County residents sign up for a pledge to improve air quality by November 2020.

- ♦ **Strategy 1:** To host a competition between colleges in Erie County to see who can get the most people to sign the pledge.
  - ◊ **Tactic 1**: To produce and provide contest posters to each participating campus. The posters would highlight the rules of the competition, how they can participate, and why they should join our pledge to improve air quality.
  - ◊ **Tactic 2:** To reach out to environmental science programs via email with information on how to participate in the competition. We would target the environmental science programs first, because students in those programs are more likely to join our pledge and the competition.

- **Tactic 3:** To host a kickoff/countdown event December 1 to inform students that there is one month until the competition begins before they leave for Christmas break. The competition would begin January 1 while students are still on Christmas break. However, we want them to be aware of the competition prior to leaving campus.

- **Strategy 2:** To utilize social media.
  - **Tactic 1:** To create video testimonials (compilations) of environmentally conscious people who have signed the pledge to be shared on college campuses and on social media. The testimonials would further explain the importance of joining the competition and signing the pledge as well as provide an example of those who have joined explaining why they joined the competition.
  - **Tactic 2:** To have one social media post per week to provide tips to improve air quality/decrease air pollution (Air Quality Tip Tuesday). These tips would be a quick, simple way to share facts about air quality that the target audience to inform and raise awareness.
  - **Tactic 3:** To promote events that we are holding (countdown, competition) throughout the campaign. Facebook events can help us to gauge how many people would be interested in attending our healthy air walk or our tree planting event. We can use social media to also post reminders about upcoming events and share pictures from the events.
- **Strategy 3:** To design messaging surrounding car pollution, dangers of emissions, etc.

- ◊ **Tactic 1:** To design stickers/logos for pledgees. The stickers would allow pledgees to show their support as well as encourage other individuals to pledge because they get a sticker when they join.
- ◊ **Tactic 2:** To create and provide a press release and video news release to local media outlets for National Clean Air Day (June 20) to encourage people to carpool, bike or walk to work. The press release would include facts about air quality and air pollution as well as information on how they can improve air quality and sign the pledge.
- ◊ **Tactic 3:** To create and design a billboard about car pollution. The billboard would reach a wider population of Erie County residents while they are commuting to inform them how motor vehicles can pollute the air. It can also utilize fear appeals.

Step 8: Implementation

This plan is designed to be completed over the course of a year (November 2019 to November 2020). Tactics will be implemented beginning December 2019, and the Erie County Department of Health can continue to implement these tactics through the remainder of the campaign, as well as select a different timeframe to complete tactics.

Step 9: Feedback and Future Research

The campaign plan will be implemented by the Erie County Department of Health over the course of a year. Gannon University's GCOMM 625 class of 2019 will create and begin to implement tactics until the semester ends in December 2019. At that time, the Erie County Department of Health can choose to continue the plan through November 2020. Our goal as a

class was to gather research about air quality in Erie County in order to create a campaign that could easily transfer to the Erie County Department of Health in December.

Awareness can be disseminated by escalating the audience's knowledge about outdoor air quality. Reaching out to audiences by conducting a survey via email, by meeting with parents in school, and interviewing college students can allow the ECDH to get their feedback about the campaign. Furthermore, a simple way to acknowledge the target audience's feedback is through asking short questions about how the campaign about air quality is beneficial to raise knowledge and awareness in Erie County.

The Erie County Department of Health may use the suggested evaluation tools to track the campaign's progress. Further research should be conducted on the target audience by monitoring social media analytics, checking the number of pledgees every three months, and sending out a follow-up survey of outdoor air quality knowledge and awareness. These can be used to gauge how much interaction there is between the target audience, the pledge and social media. The survey can be a form of self-reporting in which respondents would answer if their knowledge and awareness in air quality has increased. Further research will also provide more feedback about individuals' knowledge and awareness of air quality in Erie County.

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