IDENTIFYING PERCEIVED RISKS TO ENVIRONMENTAL POLLUTANTS AND NEEDS FOR RISK COMMUNICATION IN A RURAL APPALACHIAN COMMUNITY

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IDENTIFYING PERCEIVED RISKS TO ENVIRONMENTAL POLLUTANTS AND NEEDS FOR RISK COMMUNICATION IN A RURAL APPALACHIAN COMMUNITY

THESIS

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in Nutrition and Food Systems in the College of Agriculture, Food and Environment at the University of Kentucky

By
Elizabeth Hogan Travis
Lexington, Kentucky

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Lexington, Kentucky
2018

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ABSTRACT OF THESIS

IDENTIFYING PERCEIVED RISKS TO ENVIRONMENTAL POLLUTANTS AND NEEDS FOR RISK COMMUNICATION IN A RURAL APPALACHIAN COMMUNITY

The goal of this study is to determine issues rural Appalachian residents consider most important, their perceived environmental health risk, and how community engagement can potentially improve those issues. The University of Kentucky Superfund Research Center held the Appalachian Community Health and Well-being Forum at the Letcher County Cooperative Extension Office in Eastern Kentucky. A four-member panel consisted of two local health officials, a nutrition expert, and a federal scientist; answered questions from community members. The expert panel and audience members shared concerns, success stories, and highlighted efforts to promote health in the region. Community members completed a questionnaire collecting information on perceived environmental health risk, fruit and vegetable intake, and basic demographic information. The concerns raised by community members were chronic disease, poverty, pollution, mental health, and wellness. Proposed solutions were compliance, nutrition, physical activity, education, empathy, funding, community engagement, awareness, holistic health, prevention, and insurance/policy change. The programs in place to combat these issues are FARMACY, Community Health Workers, transportation services, mobile dental vans, Kentucky River Watershed Watch, research, policy changes, and the CLIK program. The questionnaire showed that residents are aware of the types of pollution in their community and believe that illness is caused by pollution in their environment. Community residents feel that pollution is not something they should have to live with, they act to protect themselves from pollution, and likely to engage in community efforts to stop pollution in their community.

Keywords: environmental risk perception, risk communication, community engagement, rural Appalachia

Elizabeth Travis
April 25, 2018
IDENTIFYING PERCEIVED RISKS TO ENVIRONMENTAL POLLUTANTS AND NEEDS FOR RISK COMMUNICATION IN A RURAL APPALACHIAN COMMUNITY

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Chapter 1

Introduction

There is a clear link between environmental exposure to pollutants and its impact on chronic disease, primarily through increased oxidative stress and inflammation (Perkins, 2016; Everett, 2011; Gist, 1995; Hennig, 2007; Hennig, 2012). Oxidative stress and inflammation are key components of chronic diseases such as obesity, diabetes, and cardiovascular disease (Hennig, 2012; Pashkow, 2008; Riccioni, 2012). In rural Appalachian communities, the prevalence of chronic diseases are higher within these regions than the nation (KyBRFS, 2016; PDA 2017). These regions are also burdened with a variety of environmental contaminants. This burden of environmental contaminants could exacerbate the preexisting chronic conditions that individuals suffer. Nutrition has been used to ameliorate chronic conditions for years with diets such as consistent carbohydrate, DASH (dietary approaches to stop Hypertension), and the Mediterranean. The link between pollutant exposure with increased oxidative stress and inflammation makes it important to focus on fruits and vegetables that are high in phytonutrients. Phytonutrients act as antioxidants and have anti-inflammatory properties that have the potential to ameliorate negative physiological effects of exposure (Hennig, 2012; Pashkow, 2008; Hoffman, 2017; Kim, 2010; Riccioni, 2012; Hennig, 2007). To effectively educate a community and encourage behavior change it is crucial to understand how community members perceive the dangers of their environment and the potential impact on their health, this concept is called risk perception (Dixon, 2009; Willett, 2010). The goal of this study is to understand how rural Appalachian community members perceive threats in their environment, what actions they take to protect
themselves and their community, fruit and vegetable intake, and self-reported health conditions.

**Research Questions**

1. What concerns do community forum attendees have about their health and well-being relative to their environment?
2. Is there an association between community forum attendees that take personal protective action from pollution in the environment and increased consumption of fruits and vegetables?
3. Is there an association between community forum attendees that take personal protective action from pollution in the environment and the number of self-reported health conditions?

**Research Hypotheses**

1. Community forum attendees will have concerns about their health and well-being relative to the environment.
2. Community forum attendees that take personal protective action from pollution in the environment will have higher intakes of fruits and vegetables than community forum attendees that do not take personal protective action from pollution in the environment.
3. Community forum attendees that take personal protective action from pollution in the environment will have a lower number of self-reported health conditions than community forum attendees that do not take personal protective action from pollution in the environment.
Chapter 2

Review of Literature

Introduction

The environment is one of many factors that can both negatively and positively impact a person’s health. Specifically, harmful effects can come from environmental contaminants, which are substances that have the potential to harm people, wildlife, and plants (WHO, 2015). Environmental contaminants that are known to have harmful impacts on health include: radon, oxides of nitrogen and carbon, sulfur dioxide, respirable suspended particulates (RSP), tobacco smoke, asbestos, volatile organic compounds (VOCs), formaldehyde, and lead. Exposure to such contaminants can exacerbate and increase risk for several chronic conditions such as diabetes, cardiovascular disease, and cancer (Hennig 2007, Hennig 2012, Watkins 2007, Hoffman 2017, Everett 2011, Ha 2007).

The state of Kentucky has higher rates of disease when compared to the nation, more specifically the Appalachian region has higher rates of smoking, arthritis, coronary heart disease (CHD), heart attack, obesity, diabetes and chronic obstructive pulmonary disease (COPD) (KyBRFS 2017, PDA 2017). The higher incidence of disease and level of environmental contamination found in the Appalachian region creates a hazardous combination to the health of individuals living in the region. Physiologically, individuals with chronic diseases such as obesity, diabetes, and heart disease have increased inflammation, making them more susceptible to environmental contaminants that can
exacerbate the inflammatory responses leading to oxidative stress and the production of free radicals (Perkins 2017, Hennig 2007).

Health and the environment are aspects of rural Appalachian communities that leave residents feeling hopeless. A seemingly simple solution, better nutrition, has the potential to improve certain disease states and protect individuals from the effects of environmental contamination (Hennig 2007, Hennig 2012). This provides the perfect opportunity for the University of Kentucky Community Engagement Core (UK-CEC) to partner with Appalachian residents and provide nutrition education pertaining to how their health is affected by their environment and how nutrition can mitigate the health risks associated with exposure to environmental pollution.

**Region Demographics**

There are 54 counties that make up the Kentucky Appalachian region. The Kentucky Behavioral Risk Factor Survey (KyBRFS) splits the Kentucky counties into Area Development Districts (ADD), for program planning because the sample sizes per county are too small (KyBRFS 2017). Pike, Floyd, Martin, Magoffin, and Johnson counties make up the Big Sandy ADD and Letcher, Knott, Perry, Leslie, Breathitt, Owsley, Lee and Wolfe counties in the Kentucky River ADD; Cumberland Valley ADD includes Rockcastle, Jackson, Laurel, Clay, Whitley, Knox, Bell, and Harlan counties. Lastly, the FIVCO ADD includes Greenup, Boyd, Carter, Elliot, and Lawrence counties (KyBRFS, 2017). When compared to other ADD in the state of Kentucky and the nation, these Appalachian counties have higher incidence of chronic disease, depressive disorders, and current smokers (See table 1.0). When comparing Appalachian Kentucky
to other Appalachian regions, Kentucky has the highest mortality rate of heart disease (PDA, 2017).

Table 1.0 Percentages of Adults with Chronic Conditions

<table>
<thead>
<tr>
<th></th>
<th>Kentucky River ADD</th>
<th>Big Sandy ADD</th>
<th>Cumberland Valley ADD</th>
<th>FIVCO ADD</th>
<th>Kentucky</th>
<th>Nationwide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arthritis</td>
<td>47.2</td>
<td>44.8</td>
<td>48.1</td>
<td>37.3</td>
<td>33.5</td>
<td>25.8</td>
</tr>
<tr>
<td>Depressive Disorder</td>
<td>28.5</td>
<td>34.4</td>
<td>30.8</td>
<td>25.5</td>
<td>23.3</td>
<td>17.4</td>
</tr>
<tr>
<td>Heart Attack</td>
<td>10.4</td>
<td>9.5</td>
<td>9.0</td>
<td>9.2</td>
<td>7.2</td>
<td>4.4</td>
</tr>
<tr>
<td>Heart Disease</td>
<td>10.9</td>
<td>8.6</td>
<td>7.2</td>
<td>9.2</td>
<td>6.7</td>
<td>4.1</td>
</tr>
<tr>
<td>Diabetes</td>
<td>18.8</td>
<td>17.4</td>
<td>18.2</td>
<td>20.1</td>
<td>13.1</td>
<td>10.5</td>
</tr>
<tr>
<td>Obesity</td>
<td>42.5</td>
<td>41.5</td>
<td>35.6</td>
<td>43.2</td>
<td>34.2</td>
<td>29.9</td>
</tr>
<tr>
<td>Asthma</td>
<td>14.5</td>
<td>16.0</td>
<td>15.1</td>
<td>14.5</td>
<td>11.6</td>
<td>9.3</td>
</tr>
<tr>
<td>COPD, Emphysema, or Bronchitis</td>
<td>21.2</td>
<td>23.7</td>
<td>17.2</td>
<td>14.4</td>
<td>11.4</td>
<td>6.3</td>
</tr>
<tr>
<td>Current Smokers</td>
<td>29.3</td>
<td>29.1</td>
<td>32.7</td>
<td>24.2</td>
<td>24.5</td>
<td>17.1</td>
</tr>
</tbody>
</table>

Statistics in **bold** indicate that values are higher than the national average
Statistics in *italics* indicate that values are higher than the state average.

There is evidence that residents of rural location are more likely to be obese and participate in obesity-related behaviors than individuals living in more urban settings (Butterworth, 2016). This conundrum introduces the concept of the built environment; the built environment being the way our community is built and how it can promote or inhibit healthy behaviors (Feng, 2010; Butterworth, 2016). There is further evidence to support the link between the built environment and obesity, particularly low socioeconomic areas with decreased opportunities for physical activity and increased
access to fast food and convenience stores (Booth, 2005; Butterworth, 2016). These factors could contribute to the higher incidence of obesity and obesity-related conditions in residents of rural communities than urban communities (Hansen, 2015; Butterworth, 2016). 37 out of the 54 Appalachian counties in Kentucky are considered economically distressed. The poverty rate in the Appalachian region of Kentucky is 25.4%; which is higher than the poverty rate in the Appalachian region (17.2%), Kentucky (18.9%), and the nation (15.6%) (ARC 2017). The three-year average unemployment rate for Appalachian Kentucky is 9.8%, which is higher than Kentucky (7.6%), the Appalachian Region (7.5%), and the nation (7.2%) (ARC 2017). For the economically distressed counties, the lowest per capita income is $9,763 for McCreary county and the highest per capita income $20,131 in Perry county (ARC 2017).

Mental health and substance abuse are growing concerns in the region. Methamphetamine use in the Appalachian region is increasing at a similar rate as the nation, but remains slightly lower than the nation (NORC, 2008). Opiate and synthetic drug use is higher within the Appalachian region, especially in coal-mining regions (NORC, 2008). The use of Heroin is lower in the Appalachian region but rising at a similar rate to the nation (NORC, 2008). Cigarette smoking is higher in both adolescents and adults in the Appalachian region when compared to the nation (NORC, 2008; KyBRFS, 2016). Mental health is another major issue that the Appalachian region is fighting; not only is there a higher prevalence for mental health disorders within the region but adults are reporting serious psychological distress and major depressive disorders; with highest rates found in the central Appalachian regions of Kentucky and
Tennessee (NORC, 2008). The Appalachian region reports 14% more physically and mentally unhealthy days than the nation, overall (PDA Inc., 2017).

**Pollution and University of Kentucky Superfund Research Center**

In the 1970s, toxic waste dumps received national attention when the public became concerned with how the exposure to toxic waste could impact their health. Congress passed the Comprehensive Environmental Response, Compensation, and Liability Act (CERLA), or Superfund, which allows the Environmental Protection Agency (EPA) to clean up contaminated sites (EPA, 2017). The goal of Superfund is to protect human health and the environment, make responsible parties pay for cleanup efforts, involve communities in cleanup, and ensure Superfund sites get back to production (EPA, 2017). The EPA has created a National Priorities List (NPL) that contains the names and locations of known or threatened releases of hazardous substances, contaminants, or pollutants (EPA, 2017). Kentucky has 20 NPL Superfund hazardous waste sites, 14 of which are still active sites. Kentucky has more than 500 Federal and state Superfund sites (UKSRC, 2015).

The National Institute of Environmental Health Sciences (NIEHS) conducts research on how the environment affects individuals and to promote healthier lives (NIEHS, 2017). The NIEHS sponsors community forums nationwide in communities that are affected by environmental pollutants (NIEHS 2017). The goal is to bring together community members with federal, state, and local government officials, environmental health professionals, and advocacy groups to establish better communication and coordination to combat local environmental issues (NIEHS, 2017).
The University of Kentucky Superfund Research Center, which often partners with NIEHS to conduct research, examines the role that healthy nutrition and lifestyle choices can play in minimizing the negative health impacts related to chemical exposures (UKSRC, 2015). The UK SRC focuses on exposures to chlorinated organic compounds; specifically, polychlorinated biphenyls (PCBs) and trichloroethylene (TCE) which are commonly associated with the Superfund sites in Kentucky (UKSRC, 2015).

The University of Kentucky Community Engagement Core (CEC) is housed within the UK SRC and partners with community members and groups affected by environmental pollutants to educate, inform, and empower them to take steps to improve their own health through findings from nutrition-related research conducted by the UK SRC (UKSRC 2018). The CEC develops relationships with community leaders, including health professionals, Kentucky Cooperative Extension Service agents, and senior center directors to establish trust among community residents and assess needs of the communities. The CEC has developed several curricula to educate and inform people on how the environment can impact their health and how nutrition can help (UK CEC, 2018). The CEC has developed the “Body Balance: Protect Your Body from Pollution with a Healthy Lifestyle” project, which provides eight lessons that Kentucky Family and Consumer Science Cooperative Extension agents can use to inform community members of health risks associated with exposure to environmental pollutants, to educate on phytonutrients found in fruits and vegetables to mitigate negative health effects from exposure, and strategies to increase fruit and vegetable consumption in an affordable manner (UK CEC, 2018). The “Color Your Plate” and “Berry Care” curricula are geared towards educating older adults. The “Color Your Plate” curriculum educates older adults
that attend senior centers on how to increase fruit and vegetable consumption affordably and to eat a variety of fruits and vegetables to consume a multitude of phytonutrients for health benefits. “Berry Care” makes phytonutrient-rich blackberries accessible to vulnerable populations. This project also focuses on educating communities on the benefits of phytonutrients and has the potential to engage community members of all ages in the cultivation of the blackberry bushes.

**Pollutants and Association to Disease**

**Polychlorinated Biphenyls**

PCBs are no longer used commercially, but are a class of synthetic chemicals that have been used in coolants, lubricants, and flame retardants in electrical equipment (ATSDR, 2014; Perkins, 2017; and Everett, 2011). PCBs can persist in air, soil or water for long periods of time and can travel long distances through air, stick to bottom sediments in water, and bind to soil (ATSDR, 2014; Everett, 2011). PCBs have long been associated with diabetes, hypertension, cardiovascular disease, and cancer; the risk factors, sedentary lifestyle and poor nutrition, associated with these conditions make people more vulnerable to environmental pollutants and chronic diseases including CVD (Perkins, 2017; Ha, 2007; Everett, 2011). The mechanism by which PCBs impact hypertension and diabetes is not well known but studies have shown that individuals with diabetes have higher levels of PCBs and may affect insulin secretion rather than cause insulin resistance (Everett, 2011). What is known regarding the mechanism of PCBs is that exposure creates free radicals within the body which trigger pro-inflammatory responses that are commonly seen in obesity, high blood pressure, diabetes, and atherosclerosis in CVD (Ha, 2007; Hennig, 2012). This prolonged exposure leads to
increased oxidative stress (creation of free radicals) and leads to disruption in cell membranes (Hennig, 2012). The consumption of antioxidant-rich foods and anti-inflammatory promoting foods can create a balance within the body to prevent the over production of free radicals and prevent the activation of pro-inflammatory pathways observed in most chronic conditions including diabetes, hypertension, and CVD (Hennig, 2012).

**Trichloroethylene**

TCE was commonly used as a solvent to remove grease, in the manufacture of other chemicals, as a refrigerant, and a component of adhesives, paints, and pesticides (ATSDR, 2015; Gist, 1995). TCE is broken down rapidly when released in the air but can be retained by soil and groundwater for longer periods of time (ATSDR, 2015). TCE is lipophilic which allows it to penetrate cell membranes and is metabolized primarily in the liver and marginally in the lungs making these organs particularly susceptible (Gist, 1995; Dumas, 2018). TCE exposure has been known to generate free radicals and cause lipid peroxidation which could lead to cell membrane damage and even cell death (Dumas, 2018). TCE exposure has been linked to a rare type of pulmonary hypertension called pulmonary veno-occlusive disease and may cause various respiratory symptoms such as asthma and inflammation in the lungs and nasal membranes (Dumas, 2018). - There is evidence in epidemiological studies that support that TCE is linked to liver and kidney cancers (Chiu, 2013; Alanee, 2015). In animal studies, there is evidence to support that TCE plays a role in cardiac toxicity which causes damage to heart muscles leading to arrhythmias and developing heart failure (Chiu, 2013; Gist, 1995).

**Arsenic**
Arsenic contamination of private wells, rivers, and other water sources in the Central Appalachian region is a growing concern. Private wells are a major focus for research in Arsenic contamination because Arsenic can be found in ground water and most wells draw from groundwater. The health concern is that 90% of rural Kentuckians use private wells for drinking, cooking, cleaning, and doing laundry (Shiber, 2004).

Chronic exposure to Arsenic has been linked to lung and bladder cancer, cardiovascular disease, high blood pressure, and diabetes (Shiber, 2004). The U.S. Environmental Protection Agency states that 10 parts per billion (ppb) is the Maximum Contamination Level (EPA, 2001), this has been controversial because exposure to Arsenic at levels as low as 3 ppb has shown adverse health effects indicating that the maximum contamination level should be decreased. In a study conducted by John G. Shiber, Arsenic contamination was examined in private wells in Appalachia. Kentucky had 77 private wells that contained some level of Arsenic; the greatest number of contaminated wells came from Floyd (21), Johnson (23), Magoffin (11), and Pike (10) counties. There were 35 wells with Arsenic levels between 0.5-1.0 ppb, 26 wells with levels between 1.1-3.0 ppb, five wells with levels between 3.1-5.0 ppb, 9 wells with levels between 5.1-10.0 ppb, and two wells with levels greater 10 ppb (Shiber, 2004). This is not to say that every domestic well in central Appalachia is contaminated with Arsenic but routine monitoring and testing is important. There is evidence that exposure to Arsenic leads to an increase in proinflammatory markers present in atherosclerosis, myocardial infarction, and diabetes (Chen, 2007).

*Escherichia coli*
The Kentucky River Watershed Watch (KRWW) routinely monitors and tests lakes, rivers, and streams within the Kentucky River Basin which spreads through 41 counties and contains 16,000 miles of streams (KRWW, 2015). The KRWW routinely checks levels of dissolved oxygen, pH, temperature, flow, conductivity, turbidity, bacteria, chlorides, sulfates, phosphorous, nitrogen and metals which can be indicative of potential contamination. Escherichia coli (E. coli) is a bacterium of concern in the Appalachian region because it is found in the feces of animals and humans. The presence of E. coli indicates that the water may be contaminated with human or animal feces (USEPA, 2017). Should the water contain a disease-causing microbe then symptoms include diarrhea, stomach cramps, nausea, and headache (USEPA, 2017). Kentucky uses the criteria that E. coli cannot exceed 240 colonies per 100 ml in twenty-percent of the sample taken in a given month (KRWW, 2016). KRWW reports that E. coli was tested 3 separate times in 2016 and found that in May, 39% of samples were in the fair category which between 240-1,000 cfu/100ml and 24% of samples were rated poor (>1000cfu/100ml). July sampling reported that 39% of samples were fair and 37% were poor. In September when the rainfall and river flow was at its lowest 60% of samples were good (<240 cfu/100ml), 24% fair, and 15% poor; these decreased rates at the lowest rainfall indicates that E. coli contamination may be caused from sources of runoff-straight piping from septic systems, pastures, and waste from wildlife (KRWW, 2016). E. coli contamination is a persistent problem in the Appalachian region, particularly in rivers, lakes, and streams throughout the region which prevents swimming and other recreation, as well as contamination of drinking water which leads to water-boiling advisories.
Overall, environmental contaminants have been shown to affect the human body through almost all body systems and in a multitude of ways. One of the most important being that exposure to environmental contaminants leads to inflammation and oxidative stress throughout the body; this is the same response the body gives when being overcome by chronic diseases like obesity, diabetes, and cardiovascular disease. Healthy nutrition and an active lifestyle can greatly improve the inflammation and oxidative stress throughout the body.

**Healthy Diet against chronic disease and environmental pollution**

**Polyunsaturated Fatty Acids**

Polyunsaturated Fatty Acids (PUFA) are essential nutrients in the human body, meaning that our bodies cannot make them so the nutrients are obtained through diet (Gropper, 2013). The two types are omega-3 and omega-6 fatty acids; omega-6 fatty acids consist of linoleic acid, γ-linolenic acid, eicosatrienoic acid, and arachidonic acid. Omega-3 fatty acids are composed of α-linolenic acid, eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) (Gropper, 2013). Omega-6 fatty acids, in excess, can trigger pro-inflammatory markers that promote heart disease and intensify inflammatory responses from persistent organic pollutants (Gropper, 2013; Hoffman, 2017; Hennig, 2012; Watkins, 2007). Whereas, omega-3 fatty acids trigger an anti-inflammatory response to protect against heart disease and nullify inflammatory responses from environmental pollutants. (Gropper 2013, Hoffman 2017, Hennig 2012, Watkins 2007).

Omega-6 fatty acids are found in various vegetable oils such as corn, safflower, soybean, cottonseed, sunflower, and peanut oils, as well as animal fats. Omega-3 fatty
acids are found in linseed and soybean oils as well as fish oils (Gropper 2013). Omega-6 and omega-3 fatty acids are both essential to the diet but have different physiological responses within the body. In excess, omega-6 fatty acids are pro-inflammatory which leads to an increased risk of cardiovascular disease (Watkins, 2007). There is evidence that linoleic and arachidonic acid intensify the inflammation caused by exposure to environmental pollutants (Hennig, 2012). Omega-3 fatty acids, particularly DHA and EPA, are considered anti-inflammatory and potentially reduce the risk of cardiovascular disease (Watkins, 2007; Hennig, 2012; Hennig, 2007). Further evidence shows that omega-3 fatty acids may be able to stabilize existing plaque and restore endothelial function within cells (Watkins, 2007).

**Phytonutrients**

A healthy diet such as, the Mediterranean diet has been used to improve inflammation and many other side effects associated with chronic conditions like heart disease and diabetes. The Mediterranean diet is high in fruits, vegetables, legumes, beans, nuts, seeds and monounsaturated fats; dairy products, fish, poultry, and eggs are consumed in low to moderate amounts (American Heart Association, 2018). Fruits, vegetables, legumes, grains, herbs, spices and tea contain phytochemicals, which are nonnutritive compounds that become biologically active in the human body to exhibit antioxidant and anti-inflammatory properties that have been shown to reduce adverse health outcomes associated with environmental exposure (Gropper, 2013; Riccioni, 2012; Hoffman, 2017; Watkins, 2007; Pashkow, 2008; Hennig, 2007; Hennig, 2012). There are several different classes of phytochemicals including carotenoids, terpenes, organosulphides, phenolic acids, lignans, saponins, phytosterols, glucosinolates, and
isothiocyanates (Gropper 2013). In Table 1.1 the food sources highest in each phytochemical class are listed.

<table>
<thead>
<tr>
<th>Phytochemical Class</th>
<th>Food Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carotenoids</td>
<td>Tomatoes, pumpkins, squash, carrots, and watermelon</td>
</tr>
<tr>
<td>Terpenes</td>
<td>Citrus fruits and cherries</td>
</tr>
<tr>
<td>Organosulphides</td>
<td>Garlic, onions, leeks, broccoli, cabbage, and Brussel sprouts</td>
</tr>
<tr>
<td>Phenolic acids</td>
<td>Blueberries, cherries, pears, apples, oranges, grapefruit, white potatoes, raspberries, and strawberries</td>
</tr>
<tr>
<td>Lignans</td>
<td>Berries, flaxseed oil, and nuts</td>
</tr>
<tr>
<td>Saponins</td>
<td>Potatoes, tomatoes, and ginseng</td>
</tr>
<tr>
<td>Phytosterols</td>
<td>Vegetable oils</td>
</tr>
<tr>
<td>Glucosinolates</td>
<td>Broccoli, cabbage, Brussel sprouts, and watercress</td>
</tr>
<tr>
<td>Isothiocyanates</td>
<td>Broccoli, cabbage, Brussel sprouts, and watercress</td>
</tr>
</tbody>
</table>

Adapted from Gropper 2013

Astaxanthin is a red carotenoid pigment in the Xanthophyll class commonly found in salmon, yeast, shrimp and trout (Ambati, 2014; Riccioni, 2012). The structure of astaxanthin allows it to insert itself in lipid membranes and capture free radicals; it also inhibits the secretion of free radicals, reactive oxygen species, reactive nitrogen species, and proinflammatory markers that cause atherogenesis (Riccioni, 2012; Pashkow, 2008). These actions by astaxanthin show that not only could it prevent atherogenesis but it could also stabilize existing plaque and decrease the risk of rupture (Riccioni, 2012; Pashkow, 2008).

Lycopene is an antioxidant in the carotenoid family, found in tomatoes, grapefruits, and watermelon. Lycopene may inhibit cholesterol formation and help promote the breakdown of low-density lipoprotein (LDL); due to its structure it has high oxygen binding capabilities which make it ideal for scavenging free radicals (Kim, 2010; Riccioni, 2012). Studies have shown that serum Lycopene concentrations are inversely
correlated to the thickness of arteries; lower lycopene concentrations show a thickening of arteries (Riccioni, 2012; Kim, 2010). Lutein is a xanthophyll carotenoid found in a variety of foods such as: green leafy vegetables, butternut squash, kiwi, grapes and corn (Sommerburg, 1998; Humphries, 2003). Lutein scavenges free radicals such as superoxide, hydroxide, NO radicals and evidenced to prevent lipid peroxidation (Riccioni, 2012). Resveratrol is a polyphenol found in grapes and berries and has been evidenced to mitigate oxidative stress and combat disturbances to glucose homeostasis caused by PCB exposure, which indicate that resveratrol may prevent the development of type 2 diabetes (Hoffman 2017).

**Risk Perception and Risk Communication**

Risk perception can be defined as a judgement or feeling that one gets regarding the hazards or dangers associated with an environmental issue (Weber, 2000; Janmaimool, 2014). Risk perception is a difficult construct to measure, even with the most rigid parameters, because individuals perceive threats differently. Perceived risk is influenced by many factors, including: psychological, cognitive, behavioral, and social factors (Weber, 2000; Janmaimool, 2014). Psychological and cognitive factors include ability to control, experiences, perceived benefits, and concerns (Janmaimool, 2014) but also include how individuals approach, understand, and interpret the environmental risk (Weber, 2000). For example, an individual that perceives the capability to control the environmental threat will likely have a lower perceived risk to the threat. Individuals may perceive the benefit provided by the industry sourcing the pollution to outweigh the unforeseen health risks. Individuals may have other concerns in their life that mitigate the perceived risk of their environment. Janmaimool found that individuals living in
communities that are at high- to moderate risk of environmental pollutions had a higher perceived risk than individuals living in communities that were at a low-risk to pollutants (Janmaimool, 2014). Awareness and knowledge of certain environmental issues is important but this alone does not promote individuals into action of protecting themselves from exposure (Dixon, 2009). Research shows that individuals’ perceptions or feeling toward environmental issues is more pertinent than factual information regarding the issue (Weber 2000). To understand risk perception, it is important to understand how individuals engage in environmental health issues, what people think about the issues in their community, and what preventative measure people are taking to protect themselves from exposure (Dixon 2009).

Assessing Perceived Environmental Health Risks with Questionnaires

Environmental Health Engagement Profile

Dixon et al. conducted a study to develop and validate an instrument for assessing the way that people engage in environmental issues, their experiences with environmental health hazards, perceptions of risk, and protective actions that are taken either individually or communally (Dixon 2009). The development of the survey took place in three phases: the first phase included a series of qualitative interviews to develop content, the second included a review of the content by a panel of experts, and third was testing the survey. The preliminary interviews, either individual or focus groups, were conducted with 41 urban residents; 11 of which lived in areas that had potential environmental health hazards. The interviews included questions about illnesses being caused by an environmental problem, thoughts and concerns about the healthiness of the environment and community, self-protective action from unhealthy environments, willingness to
participate in organized efforts to improve the environments and if such efforts would be successful. The interviews resulted in a pool of 399 items that reflected concern and action; after eliminating redundant items, there were a total of 56 items that were broken into three dimensions: Concerns, Actions, and Pollution Type. The expert panel was given a review form to rate the potential items based on their relevance to each corresponding dimension. At the recommendation of the experts’, 15 items were deleted, 36 were revised, 5 were unchanged and 5 items were added to the final version of the Environmental Health Engagement Profile (EHEP) that would be tested in phase 3. The EHEP instrument was tested to determine the internal structure, to evaluate reliability and explore relationships among all variables. The testing of EHEP was conducted through a series of telephone interviews with a sample of 433 people with 264 women and 169 men; 58 were Hispanic and 78 were African American with a mean age of 46 years. This final version of the EHEP included 46 items: 14 items for Pollution Type, 14 items for Actions, 18 items for Concerns. Additional sections were added to assess demographic characteristics, social involvement, goodness of life, and health characteristics. The results showed that people know there is a connection between environmental factors and health issues; some participants were concerned about environmental health and more likely to act while others were not. Correlation matrices were conducted on each dimension: all 14 items of the Pollution Type were considered reliable so it was renamed the Pollution Sensitivity Scale, the items of ‘Concerns’ was split into two factors that were named Causes-Illness Scale and the Pollution Acceptance Scale, the 14 items of the ‘Action’ dimension were split into two factors that were named Community
Environmental Action Scale and the Personal Environmental Action Scale. Three of the five scales had internal consistency reliability.

**Environmental Health Engagement Profile Kentucky Nutrition Version**

Jones et al. modified the original Environmental Health Engagement Profile to include statements regarding nutrition and environmental pollution (Jones 2017). In total, fourteen nutrition statements were added to the Environmental Health Engagement Profile, with at least one statement in each of the five categories: Pollution Sensitivity Scale, Pollution Acceptance Scale, Pollution-Causes-Illness-Scale, Personal Environmental Action Scale, and Community Environmental Action Scale. See Appendix A for survey statements. The EHEP Kentucky Nutrition Version also changed the format of the questionnaire to a paper and pencil format rather than a telephone interview format. Internal consistency reliability was tested for each scale of the survey with the updated nutrition statements and all showed good internal consistency reliability (Jones 2017).

**Neighborhood Characteristics**

Mujahid et al. developed a scale to determine whether neighborhood characteristics inhibit or promote the development of hypertension. The walking environment, availability of healthy foods, safety (level of crime or violence), and social cohesion were used to define neighborhood characteristics. Participants answered questions regarding their neighborhood which was defined as one mile surrounding the participants house, on a 5-point Likert scale (1= strongly agree and 5=strongly disagree). The results of the telephone questionnaire showed fifty percent of the sample had
hypertension, prevalence was highest in African-Americans and lowest in Caucasian individuals and the prevalence of hypertension decreased with higher income and education (Mujahid 2008). Greater income and education were associated with better walkability, availability of healthy foods, safety, and social cohesion and a lower probability of hypertension (Mujahid 2008). Individuals that were living in lower income areas rated poor neighborhood characteristics were more likely to be hypertensive. This scale provides insight on how individuals perceive the neighborhood they live in and how this perception can impact their health.

**Risk Communication**

The understanding of risk perception has become a key component to creating effective risk communication. Risk communication being the delivery of a message from public health officials to the general public (Dixon 2009). The concept of risk perception has provided researchers with insight into how people perceive their environment and what they see as a threat to their health; this has become an important part of the work of the UK-SRC Community Engagement Core (CEC). Risk communication is the process of informing people about potential hazards to themselves, their property, or community (EPA, 2016). Risk communication is defined by scholars as a science-based approach for communicating effectively in situations that are high stress, concern, or controversy (EPA, 2016). There are several approaches used for conveying risk communication information including written, verbal, or visual statements. Risk communication provides a two-way conversation in which health professionals inform, and is informed by affected community members (EPA, 2016).

**Conclusion**
The human body is constantly exposed to elements that can promote or inhibit health. The link among chronic disease and the exposure to environmental pollutants is oxidative stress and inflammation. Oxidative stress and inflammation are also influenced by lifestyle and diet; improving or eliminating unhealthy lifestyle habits and increasing healthy nutrition have been shown to reduce oxidative stress and inflammation within the body. Specifically, phytonutrients found in fruits, vegetables, grains, and oils are linked to improving oxidative stress and inflammation linked to cardiovascular disease, diabetes, and even cancer. There are many factors to consider when trying to impact behavior change, especially in rural Appalachian communities. It is important to understand the community and how they perceive the issues in their community, from there researchers can focus risk communication efforts to issues that the community find important.
Chapter 3: Methodology

Research Design

This qualitative study consisted of an audience-centered community forum, the Appalachian Health and Well-being community forum. The forum was held one evening in July 2016 at the Letcher County Cooperative Extension office in Eastern Kentucky. At the request of the director of National Institutes of Health (NIH), National Institute of Environmental Health Sciences (NIEHS), the UK-SRC was asked to host a community forum to bring together community members, federal, state, and local government officials, health professionals, and advocacy groups to address regional health disparities, raise issues and concerns regarding health, well-being, and the environment, and to highlight efforts to combat such disparities. Letcher County was chosen as the target location because of the health disparities that afflict it and surrounding rural Appalachian communities. The community forum was publicized six weeks in advance in Letcher, Harlan, Leslie, Perry, Knott, Floyd, and Pike counties by posting flyers in local businesses, health clinics, extension offices and health departments and emailing the flyer to local government officials, health professionals and advocacy group leaders in each county. This study was approved by the Institutional Review Board at the University of Kentucky.

The two-hour community forum consisted of written and verbal questions provided by the audience members to a four-member expert panel. A respected community leader served as the master of ceremony (MC). The panel consisted of two local health officials, a nutrition expert, and a federal scientist. The audience included approximately 37 community members, which included city officials, local business
owners, community advocates, local media, and healthcare providers. During the forum, 18 questions were either submitted via notecards to the MC or verbally expressed. The expert panel and audience members shared concerns, insights, solutions, success stories, and highlighted local, state, and national efforts to promote health in eastern Kentucky. The community forum was video- and audio-recorded and transcribed verbatim by study personnel. This study has been approved by the Institutional Review Board of the University of Kentucky.

**Questionnaire**

As participants arrived they were asked to complete and return an anonymous ten-page questionnaire before leaving the forum. The questionnaire collected information pertaining to perceived health risk of the environment, fruit and vegetable intake, and basic demographic information including age, height, weight, education level, and self-reported health. The questionnaire included questions from the validated EHEP Kentucky Nutrition version. The EHEP assessed the way people engage in environmental health issues including people’s experiences, the risks, and protective actions taken to oppose environmental health hazards [individually and as a community in fifty-six questions] (Jones, 2016). The questionnaire contained five scales, the Pollution Sensitivity Scale, Pollution-Causes-Illness scale, Pollution Acceptance Scale, Personal Environmental Action, and Community Environmental Scale. Each scale contained a Likert Scale ranging from 0 to 10, with responses ranging from none to very serious, disagree to agree, never do this to always do this. The neighborhood characteristics questionnaire was adapted and included to assess community characteristics including the walking environment, physical activity opportunities, the availability of healthy foods, safety, and community values from the validated sixteen-question questionnaire by Mujahid et al.
The neighborhood characteristics questionnaire consisted of five categories of questions regarding the walking environment, availability of healthy foods, level of safety, and the social cohesion within a community. The responses were recorded on a 5-point Likert scale, with 1 being “Strongly Disagree,” 5 indicating “Strongly Agree”, and 3 indicating a neutral response (Mujahid, 2008).

To capture the frequency of fruit and vegetable consumption, the Behavioral Risk Factor Surveillance System (BRFSS) questionnaire was included in a six-question self-administered format similar to Field et al. (Field, 1998). This section made inquiries about a participants’ fruit and vegetable intake within the past 30 days. Intakes were scored by the following options: 0, 1-3 servings per month, 1 per week, 2 per week, 3 per week, 4 per week, 5 per week, 1 per day, 2 per day, and 3 per day. Fruit and vegetables included fruit juices, fruit, cooked or canned beans, dark green vegetables, orange-colored vegetables, and other vegetables. The “other vegetables” category included tomatoes, tomato juice, corn, eggplant, peas, lettuce, cabbage, and white potatoes. A fruit and vegetable intake score was created from the self-reported fruit and vegetable questions. The frequency of intake was converted to an average weekly intake (0, 0.5, 1, 2, 3, 4, 5, 7, 14, or > 21 servings/week. The total fruit and vegetable score was reported as servings per day. To calculate the daily fruit and vegetable score the weekly averages were converted to serving per day by dividing the weekly totals by 7 days then averaging the sum of the serving per day of each category.

The questions pertaining to self-reported health conditions were derived from the BRFSS questionnaire (BRFSS, 2015); “Has a doctor, nurse, or other health professional EVER told you that you had any of the following?” Heart attack, coronary heart disease,
stroke, asthma, chronic obstructive pulmonary disease (COPD), emphysema, bronchitis, skin cancer, other cancer, arthritis, gout, lupus, or diabetes. The response categories included “yes” or “no”. Demographic information was also collected including age, weight, height, gender, and highest level of education.

Data Analysis

Community Forum

Verbatim transcripts were created from the audio- and visual-recording of the forum and a thematic analysis of questions and responses. This approach allows for themes to be derived directly from the raw data (i.e. the transcripts) (Thomas, 2003). The transcripts were reviewed and coded independently by two coders, one of which was immersed in data collection and analysis. The qualitative analyst reviewed the audio- and visual-recording to develop the transcript. The transcript was then read through several times by the first qualitative analyst and an initial code book was created. The second qualitative analyst independently reviewed and coded the transcript. The questions asked throughout the forum were analyzed to form open codes pertaining to issues and concerns raised by the community. Each response was collapsed to axial codes to identify patterns and relationships of themes from within the data.

Questionnaire

Data was analyzed using the Statistical Analysis System (SAS) software version 9.4. Descriptive statistics including frequencies, means, and standard deviations were calculated for demographic variables, EHEP, neighborhood characteristics, and fruit and vegetable intake responses. Goodness of Fit Chi-square analysis was used to detect
significant differences within questionnaire questions with categorical responses. To
detect significant associations between continuous variables the Pearson correlation was
used. Independent t-tests were used to detect significant associations among reported
health conditions ("yes" or "no") and fruit and vegetables intake score as well as
perceived health risk of the environment scores. Differences were considered statistically
significant at $p \leq 0.05$. 
Chapter 4: Results

There were 64 Appalachian Community Health & Well-being Community Forum attendees: 30 represented local, regional or state organizations, 29 were affiliated with academic institutions including SRCs, and 5 audience members were NIEHS staff. Representatives from local organizations included 8 community programs: 3 were environmentally-focused, 1 local government agency, 2 media organizations, 1 health clinic, 1 health program, 2 regional community organizations with a health focus, 1 statewide health insurance company, and 2 regional education institutes (non-university). There were 38 community members in attendance and 20 completed the questionnaire.

Forum

A thematic analysis of the community forum transcript resulted in three major themes: concerns, solutions, and current programs. The concerns include disease-states, environmental pollutants, and a variety of community-specific concerns highlighted by audience members, such as mental health, poverty, and wellness. The theme solutions are the proposed strategies to address the issues and concerns of the community. The final theme, current programs, includes programs already in place to address the concerns of community members. The results will be organized in groupings of concern, solution, and present programs addressing the concern; concern1, solution1, program1, and so on.

Concern 1: Chronic disease

Chronic disease, in a broad sense, was stated to be the largest emerging health issue among rural Appalachian residents. Health conditions such as Type 2 Diabetes, hypertension, and obesity were more specifically identified chronic diseases that are a
growing concern among rural Appalachian communities. When asked, one panelist stated “Well, I think chronic care diseases is our problem and that is certainly led by diabetes which is fed by obesity and it spread out to high blood pressure. It’s just a myriad of diseases that all come in on that (Community Forum Panelist, 2016).” It was largely agreed among the rest of the panelists that the connection between all chronic conditions is what makes it such an important issue to address.

**Solution 1.0: Compliance**

Compliance was suggested as a need and a solution because compliance to medical treatment and advice is low among patients at some regional healthcare facilities. Thus, if patients were compliant with medical treatment then disease states would be manageable or diminish altogether. There are several reasons why compliance is particularly low in this region, including the lack of transportation or access to healthcare facilities, lack of access and financial means to obtain healthy foods, and low literacy levels.

**Solution 1.1: Nutrition & Physical Activity**

Nutrition and physical activity are important components of improving chronic disease states. It was mentioned by a few of the panelists the importance of eating a healthy diet and exercising no matter what size a person is. “That is not for people sitting in the crowd; that you are a normal weight to think ‘oh it’s not my problem, I am a healthy weight, I can eat what I want,’ that is not at all the case. Your diet matters, no matter what size you are. Physical activity matters, no matter what size you are. (Community Forum Panelist, 2016).” Education is an important part of increasing intake
of healthy nutrition and increasing physical activity. Another important aspect is ensuring there are opportunities for physical activity and healthy food choices within the community.

**Program 1: FARMACY**

An example of how these rural communities are combatting chronic disease is by making fresh fruits and vegetables available at no cost to low-income patients of Mountain Comprehensive Health Corporation (MCHC) that are suffering from certain chronic health conditions; this has been a success through the FARMACY™ program. This program allows physicians to write a prescription for fresh fruits and vegetables to individuals that live at-or-below the poverty line and suffer from obesity, hypertension, or Type II Diabetes, or patients qualify, regardless of income, if they are pregnant or have Type I Diabetes. The prescription for fruits and vegetables are vouchers used at the local Farmer’s Market, resulting in the amount of $1 per person in the family, per day. In its first year, the FARMACY program reports a total drop in blood pressure among all participants. This program also increases availability of fruits and vegetables throughout the non-growing season, with 65 percent of participants canning and preserving fruits and vegetables.

**Concern 2: Poverty**

Audience members asked the panelists about potential connections between poverty and poor health. The panelists discussed at length that access is extremely limited among the impoverished; namely, access to healthcare, access to transportation, access to
information, and access to healthy nutrition. One panelist shared an example of the difficult choices people living in poverty often make:

“I think poverty has to do with, if you have a chronic disease and your specialist is 2 hours away from you and you don’t have transportation to get around in your own community, how do you find the transportation to get there? And when you get there for a day, I will just use this as an example, we’ve had cancer patients that have had to go to Lexington and Louisville for treatment, and yes we can find transportation like our LP services to get them there or a taxi that gets them there but they don’t have the money to eat on the day that they are there. They’re allowed to get on the bus but they can’t take anyone with them on the bus. So, you go take a treatment for cancer and get back on a bus after you wait on everyone else to finish their treatment for that day and then climb back on that bus with no one to help you when you’re so sick to your stomach you can’t sit there and be able to make that trip back to the mountains. So, poverty does have a lot to do with access, it has a lot to do with what they learn, what they hear. We can’t use big medical terms to teach people prevention, we have to use terms that people can use on an everyday language that we know that they understand and what we are trying to say to them and that they can understand (Panelist, 2016).”

This example shares the hardships faced by those living in poverty while emphasizing that addressing one aspect of poverty does not fix all the problems. Many living in poverty make decisions between wellness and necessity; healthy nutrition is another choice that often gets neglected. A few panelists shared the importance of meeting people where they are in life. For example, if fresh fruits and vegetables are not something that can be obtained then canned or frozen fruits and vegetables are suitable. Health literacy is another aspect that needs to be addressed; many people living in poverty have a low literacy level which leads to an inability to follow medical instruction.

**Solution 2.0: Education**
Health education was suggested by panelists and community members as a method for addressing health literacy in people living in poverty. One panelist discussed that people living in poverty do not have the proper information or tools to access things they need. Health education programs present important health information at a level that people with a low literacy level can understand. Community members and panelists also expressed the importance of using everyday language rather than medical terms to ensure patients understand their diagnosis and treatment options.

**Solution 2.1: Empathy**

Panelists and community members agreed that empathy is key when dealing with individuals and families of lower socioeconomic status. People are facing many different struggles, so it is important to understand what is going on in a person’s life and to meet them where they are.

**Program 2.0: Transportation Services**

There are several transportation services available within Appalachian communities to take residents to various healthcare facilities within the community and surrounding cities.

**Program 2.1: Community Health Workers**

The rural Appalachian communities utilize Community Health Worker (CHW) programs that take people from the community and train them to provide a variety of health services within the community. One panelist describes the role of a CHW as, “Basically, what we do is an initial assessment to see what the issues are that the people are dealing with on a daily basis, set goals to improve their care, give them access to
healthcare, access to dental care, all the things that they need on the medical side, but also look in on the spiritual side, and also looking on do they have depression needs (Community forum panelist 2016).” CHW programs have been largely successful in rural communities because the residents trust those individuals that were born and raised in the same community. Recently, community health workers have the capability, through a new grant, to conduct evaluations on families within the school system to determine eligibility for programs such as Medicaid, Kentucky Children’s Health Insurance Program (KCHIP), and other resources to improve overall health.

Program 2.2: Mobile Dental Vans

This Appalachian region recognizes and acknowledges that not every person has the means or capability to access their healthcare needs. Mobile dental vans have been put in place throughout the school systems, in grades kindergarten through high school, to assess dental needs and to educate children on how to take care of their teeth.

Concern 3.0: Pollution

Pollution is a large issue in this Appalachian region and became one of the highlights of the community forum. Community members had concerns regarding the link between environmental issues and chronic diseases, air and water contamination, and using community engagement to improve situations of contamination. The community members are largely aware of the contamination issues that plague the region but are not aware of how to resolve them. Water quality is one of the biggest concerns among community members who discussed that not only is the water in their community unsafe to drink but they have lost a sense of recreation, no longer being able to swim. One
panelist shared, “I also had creeks that I got to play in, and didn’t care a bit to get in it barefoot, didn’t care a bit to jump in it and swim. I wouldn’t do that today for any reason or wouldn’t encourage anybody to do that and look at what we’ve lost by the recreation that we don’t have, to be able to use our waters to put our boats in, and to ski, and those things that we would like to do that are physically active to keep us moving (Community forum panelist, 2016).” This issue of water quality also affects families that are living in poverty that cannot afford to purchase bottled water or have the means to boil water when advisories are put into effect. Air pollution and coal mining were two other environmental contaminants that were discussed during the forum, specifically the burning of coal and its impact on health and exacerbating chronic diseases. Although, majority of the coal mines in this region have ceased operation.

**Solution 3.0: Community Engagement**

All panelists agreed that there is no easy way to solve these issues of contamination but community engagement has potential to be the most effective. One key component to community engagement is making sure your voices are heard, especially by those that can impact policy changes. One panelist stated “So, I don’t think that you know feeling hopeless is going to help but actually starting to try and do something about it, working with the people who have the ability to do something to it, starting to make your voices heard, I think that will not only help say clean up the water but it’s also going to do a lot psychologically, when you make something happen. As I’ve said before knowledge is power, and so if you know there is a problem, you try to do something about it, that’s part of well-being. (Community Forum Panelist, 2016).”

**Solution 3.1: Collaboration**
Panelists discussed the importance of collaborating with other disciplines to effectively change the environmental issues within the Appalachian region. One panelist also discussed the opportunity to work with industries that may be polluting the area to help them improve practices that may be causing pollution. There was a misconception among residents that industries knowingly pollute the region to make people sick. To which one panelist stated, “I will say that I don’t think most industries want to make people sick, I don’t think that’s their objective. I think sometimes they are unaware of what it is they are doing but I think there are real opportunities here to identify where problems are and then you can do something about them (Community Forum Panelist, 2016).” Another important collaboration to consider are academic partnerships with universities throughout the state.

**Solution 3.2: Funding**

It was mentioned among panelists that funding is necessary to create programs and organizations to improve the pollution in the region and stressed to continue writing grant proposals to receive funding.

**Solution 3.3: Nutrition**

One panelist discussed the importance of healthy nutrition among those in contaminated regions and those at risk for exposure. “I just wanted to add really quick that this isn’t an answer to what you can do to stop the contamination but in the event that you are exposed to environmental contaminants, whether it’s air pollution, PCB’s, TCE’s, just going back to a healthy diet. Fruits and vegetables contain components that can help detoxify these different chemicals that you are exposed to. So as you are
working as a community to clean up areas to eliminate that toxic waste, just again eating healthy can very much make a difference.” Many audience members did not believe that a healthy diet could protect them from the risk of exposure.

**Programs 3.0: Kentucky River Watershed Watch**

Kentucky River Watershed Watch is a program that is part of a larger statewide organization called Watershed Watch that coordinates a citizen monitoring program to improve and protect water quality through community awareness. Program volunteers conduct water samples throughout the Kentucky Water Basin.

**Concern 4.0: Mental Health**

Community members have grave concerns regarding mental health and drug addiction that is afflicting this region. Community members also feel that if these issues are not addressed first then other major issues such as obesity, smoking, and physical activity will not be addressed either. Panelists discussed at length the roll that the economy can play in drug addiction and mental health with one panelist describing “So in disadvantaged communities throughout the country, there are some similarities with some of the problems, mental health is a huge issue. Whenever there is economic collapse or economic problems you almost get a PTSD kind of syndrome in people that is very hard to treat and we know that and we also know I was mentioning before, the fact that there are certain things that can happen to you that you will pass onto your children actually in a genetic kind of sense.” This is also evident in the increased number of individuals
suffering from depression in the Appalachian region, especially women. These issues have also caused changes in family dynamics with one panelist stating that one county has the highest number of children being raised by their grandparents, nationally. Stress is another condition that needs to be addressed because stress can have long term effects on children even before conception.

**Solution 4.0: Raise awareness**

One of the ways to make changes in mental health and addiction is to raise awareness of these issues and start having real conversations about how to address them. Another panelist stated that there must be hope that these issues can be improved.

**Solution 4.1: Holistic Health**

There was a discussion among panelists and community members that people’s bodies started being treated separately rather than treating the body as a whole. Unfortunately, this brings issues with reimbursement from insurance.

**Program 4.0: Research**

There are no programs currently in place to address these issues; there is research being conducted that is looking into depression among women in rural Appalachia.

**Concern 5.0: Wellness**

Wellness was discussed among community members and panelists, with both groups asking questions. One panelist discussing that the future of healthcare is changing to a focus on prevention. One community member addressed the audience on what is required to have wellness. Lastly, a community member asked the panelists how to
advocate for healthy choices when food advertising and peer influence makes a compelling case for unhealthy options.

**Solution 5.0: Prevention**

It was discussed among panelists that prevention is the best approach to improving chronic diseases. Also, that people should start going to wellness checkups and preventive health screenings.

**Solution 5.1: Insurance**

There was discussion about the changes in insurance compensation and that companies are recognizing the value in paying for preventive screening such as colonoscopies rather than large sums of money for cancer treatments that could have been prevented. Insurance reimbursement was also discussed because of its shortcomings. Specifically, when several health issues need to be addressed in one visit; insurance can only be billed for one service on one day. One panelist provided an example of this situation,

“That does deal a little bit with policy as well as reimbursement because even though you have clinic where you can have your dental work done, if the provider sees you in primary care site and says ‘oh my goodness you’ve got an infection in your mouth that we need to deal with,’ if they go over to the dentist, we can’t bill except for one service, we have to do something the next day. So, the body is still taken apart, in pieces where you have to… let’s say you’re there and that the primary care provider recognizes that you’re depressed and we do have a psychiatrist on board, sometimes it’s a three month wait to get in with the psychiatrist and so again, you’ve taken care of one part but you’ve got to wait three months to take care of the other part. So, it is a huge issue and it does have to do with policy about the way we are reimbursed as well, so there has to be changes when we make those, when we identify those
things and we have brought that to their attention many
times, let us take care of the person.”
This issue with insurance reimbursement is influenced by policy change which would be
required to make changes within insurance reimbursement. Insurance reimbursement is
also related to the concerns of holistic health which will be discussed in the next section.

Solution 5.2 Holistic Health

It was agreed among panelists and community members that treating a person’s
ailments wholly to ensure that every part of a person is well. One community member
expressed frustration with the disconnect among healthcare saying, “But, I think that a
part of it, being well is looking at the whole and a lot of times we don’t have doctors or
medical facilities that are looking at individuals as a whole, that yes you have high blood
pressure, yes you have diabetes but you also have, I don’t know I’m just trying to, I feel
like its disconnected and a lot of times that the doctors don’t connect you to where you
need to be connected next (Audience member, 2016).”

Solution 5.3: Early Education

A member of the panel discussed that the greatest impact on chronic disease
management is by prevention through early education. Particularly, educating children on
a healthy lifestyle through the school system because this provides a captive audience.
All the panel members agreed that starting education early is an effective approach to
promoting health and wellness. One panel member discussed that educating youth is a
great approach because children often influence their parents’ food choices and
purchases.

Program 5.0: CLIK
The Community Leadership Institute of Kentucky (CLIK) program is a community leadership program that teaches children how to raise, process, and market vegetables in school. This program introduces children to vegetables that they may not have access to otherwise.

**Questionnaire**

There were 38 community members asked to complete the questionnaire, 20 participants completed the questionnaire producing a response rate of 53%. The questionnaire respondents were largely female (66.7%), middle-aged 48.15 ± 16.84 years, completed a bachelor’s degree (45%) or graduate degree (35%), and an average body mass index (BMI) of 29.46 ± 5.96. The largest number of participants lived in a suburban setting (60%) and in the city of Whitesburg; participants were residents of surrounding cities including Hazard, Jenkins, Pikeville, Thornton, Fleming-Neon, and Langley.

**EHEP Scales**

The Pollution Acceptance Scale measures the types of pollution present in a person’s community (5.67±1.41). Indicating the residents of this community are largely aware of the types of pollution in their immediate environment. The Pollution-Causes-Illness Scale measures the extent to which people believe illness is caused by the pollution in the environment (6.27± 1.65), this indicates that the residents of this community believe illness they experience is caused by the pollution in their environment. The Pollution Acceptance Scale measures the extent to which community residents feel it is acceptable to live in polluted conditions (2.32±1.77); the audience feels
that pollution is not something that they should have to live with. It is important to note that the Pollution Acceptance Scale measured this indicator with a 10-point Likert scale different than the others; with 0 being “disagree completely” and 10 being “agree completely”. The Personal Environmental Action Scale measures the extent to which people protect themselves from exposure to pollution (6.35±1.44); the residents of this community do a lot to protect themselves from pollution. The Community Environmental Action Scale measures the extent to which people collaborate to prevent or stop pollution within their community (6.84±1.38), the residents of this community are likely to engage in community efforts to stop pollution within their community. Table 1.2 provides the 5 items ranked highest on each EHEP scale.

<table>
<thead>
<tr>
<th>Table 1.2 Top 5 Mean scores for each scale</th>
<th>Mean ± Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pollution Sensitivity Scale is scored 0 to 10, 0 being “none at all” and 10 being “very serious”</td>
<td>5.67±1.41</td>
</tr>
<tr>
<td>Contaminated drinking water</td>
<td>8.35±3.96</td>
</tr>
<tr>
<td>Polluted rivers, harbors, lakes, or oceans</td>
<td>8.15±1.79</td>
</tr>
<tr>
<td>Improper disposal of garbage or hazardous waste</td>
<td>7.75±2.29</td>
</tr>
<tr>
<td>Toxic places like abandoned factories or dumps</td>
<td>7.15±2.56</td>
</tr>
<tr>
<td>Mold in buildings</td>
<td>6.85±1.93</td>
</tr>
<tr>
<td>Pollution Causes Illness Scale is scored 0 to 10, 0 being “Disagree Completely” and 10 being “Agree Completely”</td>
<td>6.27±1.65</td>
</tr>
<tr>
<td>Asthma is made worse by air pollution</td>
<td>8.05±2.50</td>
</tr>
<tr>
<td>People who work with chemicals often get sick from it</td>
<td>7.74±2.51</td>
</tr>
<tr>
<td>Many people in my community have health issues because of the pollution</td>
<td>7.20±2.19</td>
</tr>
<tr>
<td>People should worry about toxic thing in their homes</td>
<td>7.15±2.68</td>
</tr>
<tr>
<td>The drinking water in my community causes health issues.</td>
<td>7.11±3.30</td>
</tr>
</tbody>
</table>
Pollution Acceptance Scale is scored 0 to 10, 0 being “disagree completely” and 10 being “Agree Completely”

<table>
<thead>
<tr>
<th>POLLUTION ACCEPTANCE SCALE</th>
<th>2.32±1.77</th>
</tr>
</thead>
<tbody>
<tr>
<td>People don’t need to worry about toxic things because our bodies can overcome the toxins</td>
<td>1.73±2.44</td>
</tr>
<tr>
<td>Pollution is just a part of modern life, so we can’t do much about it.</td>
<td>1.88±2.39</td>
</tr>
<tr>
<td>People often exaggerate the amount of sickness caused by pollution</td>
<td>1.93±2.05</td>
</tr>
<tr>
<td>If you want to eat a normal diet, you can’t spend any time worrying about contaminants in your food.</td>
<td>1.93±2.56</td>
</tr>
<tr>
<td>I am too busy to do anything about how the environment affects health</td>
<td>2.23±2.51</td>
</tr>
</tbody>
</table>

Personal Environmental Action Scale is scored 0 to 10, 0 being “never do this” and 10 being “always do this”

<table>
<thead>
<tr>
<th>PERSONAL ENVIRONMENTAL ACTION SCALE</th>
<th>6.35±1.44</th>
</tr>
</thead>
<tbody>
<tr>
<td>I drink water that is bottled or filtered- not just from a faucet</td>
<td>8.65±2.18</td>
</tr>
<tr>
<td>I wash my fruits and vegetables thoroughly before using them</td>
<td>8.20±1.58</td>
</tr>
<tr>
<td>I try to eat 5 or more servings of fruits and vegetables every day.</td>
<td>7.80±2.48</td>
</tr>
<tr>
<td>I avoid using insect sprays and pesticides because they could make people sick</td>
<td>7.65±2.62</td>
</tr>
<tr>
<td>I avoid being around people who are smoking</td>
<td>7.15±3.17</td>
</tr>
</tbody>
</table>

Community Environmental Action Scale is scored 0 to 10, 0 being “never do this” and 10 being “always do this”

<table>
<thead>
<tr>
<th>COMMUNITY ENVIRONMENTAL ACTION SCALE</th>
<th>6.84±1.38</th>
</tr>
</thead>
<tbody>
<tr>
<td>I talk with my friends and neighbors about how we can get healthier foods in our town</td>
<td>8.43±1.73</td>
</tr>
<tr>
<td>I talk with my friends about how we can get cleaner water in our town</td>
<td>7.63±2.63</td>
</tr>
<tr>
<td>I attend meeting about environmental health issues in my community.</td>
<td>7.33±2.12</td>
</tr>
<tr>
<td>I tell others about how the environment can affect health</td>
<td>7.03±1.91</td>
</tr>
<tr>
<td>I join with others in trying to keep polluting businesses out of our community</td>
<td>6.38±3.12</td>
</tr>
</tbody>
</table>

**Neighborhood Characteristics**
The walking environment scale measures the walkability and physical activity opportunities of a given community, a range of 30-80% of community members agreed or strongly agreed that their neighborhood had characteristics conducive to supporting walkability and physical activity. The Healthy Foods scale measures the availability and quality of fresh fruits, vegetables, and low-fat products; a range of 50-60% of community members strongly agreed or agreed that quality fresh fruits and vegetables, and low-fat products are available. The safety scale measures the safety of walking day or night, violence, and crime within the community and ranged from 42.11-70% that community members agreed or strongly agreed that their neighborhood was safe. The social cohesion scale measures the willingness of residents to help others, level of trust, and shared values. Among the community characteristics assessment, social cohesion had the highest level of agreement with 100% agreeing that “people around here are willing to help their neighbors” and only up to 10% disagreeing that people share the same values. Table 1.3 indicates the percent of agreement and disagreement among questionnaire respondents regarding characteristics of the neighborhood in which they live.

<p>| Table 1.3 Percent of Agreement/Disagreement for Neighborhood Characteristics |
|-----------------------------------------------------------|-----------------|-----------------|-----------------|
| Statement                                                | Strongly Agree/Agree (%) | Neutral (%) | Disagree/Strongly Disagree (%) |
| My community offers many opportunities to be physically active | 65.00 | 5.00 | 30.00 |
| Local sports clubs and other facilities in my community offer many opportunities to get exercise. | 75.00 | 0.00 | 25.00 |</p>
<table>
<thead>
<tr>
<th>Item</th>
<th>Percentage</th>
<th>Confidence</th>
<th>Trustworthiness</th>
</tr>
</thead>
<tbody>
<tr>
<td>It is pleasant to walk in my community</td>
<td>80.00</td>
<td>10.00</td>
<td>10.00</td>
</tr>
<tr>
<td>The trees in my community provide enough shade.</td>
<td>80.00</td>
<td>15.00</td>
<td>5.00</td>
</tr>
<tr>
<td>In my community it is easy to walk places</td>
<td>30.00</td>
<td>20.00</td>
<td>50.00</td>
</tr>
<tr>
<td>I often see other people walking in my community</td>
<td>65.00</td>
<td>5.00</td>
<td>30.00</td>
</tr>
<tr>
<td>I often see other people exercise (for example jog, bicycle, play sports) in my community</td>
<td>55.00</td>
<td>5.00</td>
<td>40.00</td>
</tr>
<tr>
<td>A large selection of fruits and vegetables is available in my community</td>
<td>60.00</td>
<td>15.00</td>
<td>25.00</td>
</tr>
<tr>
<td>The fresh fruits and vegetables in my community are of high quality</td>
<td>55.00</td>
<td>25.00</td>
<td>20.00</td>
</tr>
<tr>
<td>A large selection of low fat products is available in my community</td>
<td>50.00</td>
<td>25.00</td>
<td>25.00</td>
</tr>
<tr>
<td>I feel safe walking in my community day or night</td>
<td>70.00</td>
<td>5.00</td>
<td>25.00</td>
</tr>
<tr>
<td>Violence is not a problem in my community</td>
<td>35.00</td>
<td>35.00</td>
<td>30.00</td>
</tr>
<tr>
<td>My community is safe from crime</td>
<td>42.11</td>
<td>21.05</td>
<td>36.85</td>
</tr>
<tr>
<td>People around here are willing to help their neighbors</td>
<td>100.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>People in my community can be trusted</td>
<td>85.00</td>
<td>10.00</td>
<td>5.00</td>
</tr>
</tbody>
</table>
People in my community share the same values

<table>
<thead>
<tr>
<th>Fruit or Vegetable</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>100% PURE fruit juices (servings/week)</td>
<td>2.43</td>
<td>2.90</td>
</tr>
<tr>
<td>Fruit (fresh, frozen, or canned, servings/week)</td>
<td>7.80</td>
<td>5.90</td>
</tr>
<tr>
<td>Beans (cooked or canned Servings/week)</td>
<td>3.45</td>
<td>2.50</td>
</tr>
<tr>
<td>Dark green vegetables (broccoli, romaine, chard, collard greens, or spinach, servings/week)</td>
<td>8.08</td>
<td>6.05</td>
</tr>
<tr>
<td>Orange-colored vegetables (sweet potatoes, pumpkins, winter squash, orange sweet peppers, or carrots; servings/week)</td>
<td>3.25</td>
<td>1.99</td>
</tr>
<tr>
<td>Other Vegetables (servings/week)</td>
<td>10.00</td>
<td>7.24</td>
</tr>
<tr>
<td>Average servings of fruits and vegetables/day</td>
<td>5.0</td>
<td>2.23</td>
</tr>
</tbody>
</table>

Fruit and Vegetable Intake

The results of the fruit and vegetable intake score showed that intake among participants were within recommended fruit and vegetable servings (5.0±2.23 servings/day).

Self-reported Health Conditions

The top self-reported health condition was arthritis (30%), next was cardiovascular disease such as heart attack, stroke, and coronary heart disease (15%);
cancer, diabetes and asthma (10%). Chronic obstructive pulmonary disorder including emphysema and chronic bronchitis, was the least self-reported health condition (5%).

**Fruit and Vegetable Intake & Personal Environmental Action Scale**

Moderate positive correlations were found among the first item on the Personal Environmental Action Scale “I stay away from a place if I think the air will be especially dirty there,” and dark green vegetables \((r=0.47587, p=0.0339)\), other vegetables \((r=0.53538, p=0.0150)\), and total fruit and vegetables \((r=0.52632, p=0.0171)\); indicating community member that have higher intakes of dark green vegetables, other vegetables, and total fruit and vegetables are more likely to avoid places with unclean air. There were moderate positive associations for the item “I avoid using insect sprays and pesticides because they could make people sick” and Orange-colored vegetables \((r=0.44645, p=0.0485)\), other vegetables \((r=0.49514, p=0.0264)\), and total fruits and vegetables \((r=0.52950, p=0.0164)\); indicating individuals that avoid using insect sprays or pesticides are more likely to have higher intakes of orange-colored vegetables, other vegetables, and total fruit and vegetable intakes. A moderate positive relationship was identified between the item “I pick up trash that I see in the street and around my community” and orange-colored vegetables \((r=0.48967, p=0.0284)\). Moderate positive relationships were identified with the item “I do what is necessary to make sure my home is free of toxins, like lead and radon” and other vegetables \((r=0.45413, p=0.0443)\), and total fruits and vegetables \((r=0.45433, p=0.0442)\). There was a moderate positive relationship between “I eat healthy foods to make up for the effects of pollution” and other vegetables \((r=0.49418, p=0.0268)\). Moderate positive relationships between the items “I wash my fruits and vegetables thoroughly before using them” and other
vegetables ($r=0.48439$, $p=0.0304$) and total fruits and vegetables ($r=0.51530$, $p=0.0201$).

There was a moderate positive relationship for the item “I try to eat 5 or more servings of fruits and vegetables every day” and other vegetables ($r=0.53283$, $p=0.0156$) and strong positive relationship between this item and total fruits and vegetables ($r=0.62139$, $p=0.0034$).

Personal Environmental Action Scale and Self-Reported Health Conditions

**Coronary Heart Disease**

There was a statistically significant association between individuals with coronary heart disease and that ranked the item “I wash my fruits and vegetables thoroughly before using them” high on the scale ($p=0.0345$).

**Stroke**

There were statistically significant associations between the health condition, stroke, and the items “I avoid being around people who are smoking ($p=0.0159$),” “I talk to my doctor or nurse about how to reduce the effects of pollution on my health ($p=0.0320$),” and “I eat healthy foods to make up for the effects of pollution ($p=0.0332$).” The items “I avoid being around people who are smoking” and “I eat healthy foods to make up for the effects of pollution” were ranked high on the scale, $7.15\pm3.17$ and $6.15\pm3.03$, respectively. The item “I talk to my doctor or nurse about how to reduce the effects of pollution on my health” was ranked low Personal Environmental Action Scale.
Asthma

There were statistically significant associations between individuals having asthma and the items “I drink water that is bottled or filtered-not just from a faucet (p=0.0118),” and “I eat organically grown foods as much as I can (p=0.0307),” which were ranked high on the personal environmental action scale, 8.65±2.18 and 6.95±2.41, respectively.

Bronchitis

There was a statistically significant association between the health condition bronchitis and the item “I eat organically grown foods as much as I can (p=0.0307).” This item was ranked high on the personal environmental action scale, 6.95±2.41.

Arthritis

There were no statistically significant associations between the health condition arthritis and any of the items in the Personal Environmental Action Scale.

Diabetes

An association between diabetes and the item “I limit how much fist I eat because fish might contain toxic chemicals (p=0.0726)” was observed but did not reach statistical significance.
Chapter 5: Discussion

The community forum provided an open platform for Appalachian residents to present concerns regarding their community, the environment, and health. The expert panel proposed solutions to the residents’ concerns and highlighted programs in place to address their concerns, and how to get involved as a community to find solutions. The questionnaire provides insights regarding the types of pollution, personal protective action against pollution, and the likelihood of rural Appalachians to engage as a community to combat these issues.

The Pollution Sensitivity Scale indicates that abandoned factories, improper disposal of hazardous waste or garbage (7.75 ±2.29), mold (6.85±1.93), and contamination of drinking water (8.35±3.96), rivers, and lakes (8.15±1.79) are primary concerns as sources of pollution in Appalachia. These sources were also discussed throughout the community forum, particularly the contamination of water sources. Community engagement is utilized by the Kentucky River Watershed Watch to raise awareness for water contamination and coordinate a citizen-monitoring program to improve water quality.

The Pollution-Causes-Illness Scale indicates that community residents feel that the illness they experience is caused by the pollution in the environment. Specifically, mental development of children is influenced by environmental toxins (7.00 ±2.77), most cancer is caused by environmental pollution (5.79 ±2.27), the drinking water causes health issues (7.11±3.30), and asthma is made worse by air pollution (8.05±2.50). Appalachian community members are aware of the connection between their health and environmental pollution.
The Pollution Acceptance scale indicates the community regards environmental pollution as a threat to their health and is not something they should have to live with. Most participants disagree with the statement “eating a healthy diet will not make a difference in my health if I live near pollution” (3.13±2.89), this range indicates that some people have neutral responses. A respondent felt that eating a healthy diet would not improve their health if they lived near pollution, stating “this is ridiculous” in the margin of the statement. This expresses a need for nutrition education, specifically healthy nutrition and its impact on environmental exposure; providing the CEC the opportunity to develop lessons.

The results of the EHEP portion of the questionnaire indicate that participants have a higher perceived risk to many environmental issues in their community. Further, they perceive their environment to be a risk to their health. The Personal Environmental Action Scale and the Community Environmental Action scale provides the actions that participants are taking to protect themselves from environmental issues. This information provides valuable insight into how to tailor risk communication efforts within the rural Appalachian regions.

The Personal Environmental Action Scale indicates that this group takes many steps to protect themselves from environmental pollution in their community (6.35±1.44). The highest intakes of fruits and vegetables were for fruit (7.80±5.90 servings/week), dark green vegetables (8.08±6.05 servings/week), other vegetables (10.00±7.24 servings), and total fruit and vegetables (See Table 1.4). There were several associations between personal protective actions that were ranked high on the scale and the fruits and vegetables with high intakes; indicating that individuals that take personal protective
action from environmental pollutants have higher intakes for certain fruits and vegetables. The Personal Environmental Action Scale was also used to identify associations with self-reported health conditions. There were significant associations for individuals with coronary heart disease that ranked “I wash my fruits and vegetables thoroughly before using them” high on the scale. There was a significant association for individuals that have had a stroke and ranked the items “I avoid being around people who are smoking” and “I eat healthy foods to make up for the effects of pollution” high on the scale; there was an association with the item “I talk to my doctor or nurse about how to reduce the effects of pollution on my health,” which was rank low on the Personal Environmental Action Scale. This could indicate that individuals that have suffered from a stroke have become more health conscience and have a greater perceived risk since the event. Although, talking to health professionals was ranked low, individuals that have suffered a stroke may be more likely to talk to healthcare professionals about protecting and improving their health. There were associations for individuals that have asthma and drinking bottled water and eating organically grown foods as much as possible; both items were ranked high on the Personal Environmental Action Scale. This could indicate that individuals with asthma are more likely to drink bottled water and eat organically grown foods whenever possible. Individuals with bronchitis were more likely to eat organically grown vegetables. Lastly, individuals with diabetes are more likely to avoid being around people that smoke. This information provides insight into what actions people are willing to take to protect their health from environmental pollution.

Specifically, individuals with certain diseases may be more likely to take steps to protect their health from environmental contamination.
According to the questionnaire, community members are likely to act as a group to improve pollution through talking with their peers or attending community meetings. Community members expressed feeling hopeless when discussing pollution and contamination because the issues have not been resolved and believe it is the government’s responsibility to do so. Research has shown that partnerships between at-risk populations and academia are successful in identifying issues within communities and allowing community members to plan solutions and research opportunities within their community (Haynes, 2011). Further, community members believe that researchers are more knowledgeable in environmental pollutants and trust the information they can provide (Haynes, 2011).

The neighborhood characteristics scale indicates that this community feels there are opportunities for physical activity, that it is pleasant to walk in the community, but it is not easy to walk places. Sixty-percent of the participants stated that there is a large selection of fruits and vegetables available within the community and that they are high quality. This study took place in July when farmer’s markets are at their peak so the availability of fruits and vegetables may differ in the colder months when harvest slows. This community feels their neighborhood is safe but feels that violence is a problem in their neighborhood. All study participants stated that neighbors are willing to help each other out.

There were issues identified throughout the forum that have not been addressed within this region, such as mental health, addiction, and depression particularly among women. There is some research being conducted studying depression among women
living in Appalachian communities. Largely, these areas have not been studied, particularly in rural Appalachian communities.

It should be taken into consideration that the participants in this study were attending a local meeting regarding environmental health indicating that these individuals are likely more aware of the environmental issues and their impact on health than the average residents within this region. This group of people could be influential in reaching out to the general public within in their community because of their awareness of environmental health and their willingness to help others. The University of Kentucky Community Engagement Core could partner with these community members to improve environmental issues and health for the entire community.

**Limitations**

A major limitation of this study was the adaptation of the questionnaire; three separate validated surveys were combined to produce the questionnaire that was administered during the community forum. Thus, our questionnaire has not been tested for validity. The number of questionnaire respondents was small (n=20) and results are not representative of the whole community. Response bias could be a limitation for participants of the survey. There was limited time during the community forum which could have left questions unanswered and missed other issues the community felt were important to discuss. The community forum attendees represent a relatively healthy subset of the community which is not representative of the community as a whole.
Conclusion

The bidirectionality of the community forum provided panel experts and community residents with information on the types of issues that need to be addressed in rural Appalachian communities and how they can be addressed. Life in rural Appalachia is difficult and as discussed, addressing one issue does not fix all the issues that plague the region. This dialogue shed light on the issues that community members find most important, particularly the contamination of drinking water, rivers, and lakes. While community engagement opportunities are in place to improve the drinking water, access to fruits and vegetables, and access to healthcare, there are several areas that still need to be addressed; particularly, nutrition education and its role in environmental exposure. Our results show that the residents of rural Appalachian communities are aware of the environmental pollutants in their region and they are taking steps to protect themselves. Unfortunately, this is not representative of most rural Appalachian residents but this healthier subset of Appalachian residents could be influential in educating the general public. The close-knit sense of community among Appalachian residents provides a platform for community engagement in community-based participatory research to provide solutions for the issues in their region.
Appendix A: Appalachian Health and Well-being Survey

Appalachian Health and Well-Being Community Forum Survey

Are there any of these issues in your community?

Here is a list describing several types of pollution. Think about the community where you live. In the box in front of each type of pollution, put a number between 0 and 10. A 0 means that there is none of this kind of pollution at all in your community, while a 10 means that there is a very serious issue with this type. Use the number between 0 and 10 for the between ratings.

<table>
<thead>
<tr>
<th>None at all</th>
<th>Middle Ratings</th>
<th>Very Serious</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>9</td>
<td>10</td>
<td></td>
</tr>
</tbody>
</table>

☐ 1. Asbestos in buildings

☐ 2. Toxic places like abandoned factories or dumps

☐ 3. Improper disposal of garbage or hazardous waste

☐ 4. Chemicals in rugs, furniture and car upholstery

☐ 5. Pesticides - insect sprays, lawn chemicals, etc.

☐ 6. Mold in buildings

☐ 7. Radiation from nuclear power plants

☐ 8. Contaminated drinking water

☐ 9. Pesticides, hormones, antibiotics in our food

☐ 10. Polluted rivers, harbors, lakes, or ocean
11. Air pollution from factories and power plants

Are there any of these issues in your community?

(None at all  Middle Ratings  Very Serious)

0  1  2  3  4       5  6  7  8  9  10

12. Lead from peeling paint

13. Animal-waste-pet droppings, farm animal manure

14. Air pollution from trucks, buses and cars

15. Chemicals in food and beverage containers, such as cans and plastic bottles.

16. PCBs from landfills or from discarded electrical equipment getting into water and food.

17. Contaminants such as pesticides in fruits and vegetables

19. Contaminants like mercury, dioxin or PCBs in fish, meat or poultry

Do things in the environment cause people to get sick?

Here are statements about environment and health. Think about how much you agree or disagree with each statement. In each box put a number between 0 and 10. A 10 means you agree completely. A 0 means you disagree completely. Use numbers between for middles ratings.

(Disagree Completely  Middle Ratings  Agree Completely)

0  1  2  3  4       5  6  7  8  9  10

1. When people get sick, it is often because of pollution in the environment.

2. The mental development of children is harmed by toxins in the environment.

3. Many people in my community have health issues because of the pollution.

4. The air in my community looks or smells polluted.

5. Most cancer is caused by pollution in the environment.
6. The drinking water in my community causes health issues.
7. People who work with chemicals often get sick from it.
8. Asthma is made worse by pollution in the air.
9. Some schools in my community are contaminated and unhealthy.
10. The environment where I work might hurt my health.
11. People should worry about toxic things in their homes.
12. I spend time worrying about pollution being bad for my health.
13. People may get sick because they don’t eat the right foods to protect themselves from pollution.

**Do people just need to live with these things?**

Here are some statements about pollution being normal part of life which can be lived with. Use the same rating approach as above, where 10 means you agree completely and 0 means you disagree completely.

(Disagree Completely Middle Ratings Agree Completely)

<table>
<thead>
<tr>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
</table>

1. Pollution is just a part of modern life, so we can’t do much about it.
2. I don’t consider environmental issues nearly as important as other issues in my family or community.
3. I am too busy to do anything about how the environment affects health.
4. People don’t need to worry about toxic things, because our bodies can overcome the toxins.
5. People often exaggerate the amount of sickness caused by pollution.
6. Many people I know don’t seem to get sick, even though they don’t try to keep contaminants out of their food.
7. If you want to eat a normal diet, you can’t spend any time worrying about contaminants in your food.

8. Eating a healthy diet will not make a difference in my health if I live near pollution.

**Do you do things to help yourself with these issues?**

Here are statements about things you might do in your personal life for your health. Use the ratings from 0 to 10 to show how consistently you do each thing. A 10 means you always do this when it makes sense. A 0 means you never do it. The numbers between are for middle ratings.

<table>
<thead>
<tr>
<th>(Never do this)</th>
<th>Middle Ratings</th>
<th>Always do this</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
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<td>9</td>
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</tbody>
</table>

1. I stay away from a place if I think the air will be especially dirty there.
2. To keep out bad air, I close my windows.
3. I drink water that is bottled or filtered— not just from a faucet.
4. I avoid being around people who are smoking.
5. I avoid using insect sprays and pesticides because they could make people sick.
6. I limit how much fish I eat because fish might contain toxic chemicals.
7. I talk to my doctor or nurse about how to reduce the effects of pollution on my health.
8. I pick up trash that I see in the street or around my community.
9. I do what is necessary to make sure my home is free of toxins, like lead and radon.
10. I eat healthy foods to make up for the effects of pollution.
11. I wash my fruits and vegetables thoroughly before using them.
12. I try to eat 5 or more servings of fruits and vegetables every day.

13. I eat organically grown food as much as I can.

Do you do things with others in the community that help?

Here are statements about things you might do with other in the community to help protect health. Use the ratings from 0 to 10 to show how consistently you do each thing. A 10 means you always do this when it makes sense. A 0 means you never do it. The numbers between are for middle ratings.

<table>
<thead>
<tr>
<th>(Never do this)</th>
<th>Middle Ratings</th>
<th>(Always do this)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>7</td>
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</tr>
</tbody>
</table>

1. I join with others in trying to keep polluting businesses out of our community.

2. I attend meetings about environmental health issues in my community.

3. When something is polluting our community, my neighbors and I get it stopped.

4. I tell other about how the environment can affect health.

5. I talk with my friends and neighbors about how we can get healthier foods in our town.

6. I talk with my friends and neighbors about how we can get cleaner water in our town.
The following questions are about your neighborhood.
Please think about the area within approximately 1 mile of your home.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>My community offers many opportunities to be physically active.</td>
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<tr>
<td>Local sports clubs and other facilities in my community offer many opportunities to get exercise.</td>
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<tr>
<td>It is pleasant to walk in my community</td>
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<tr>
<td>The trees in my community provide enough shade.</td>
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<tr>
<td>In my community it is easy to walk places.</td>
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<tr>
<td>I often see other people walking in my community</td>
<td></td>
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<tr>
<td>I often see other people exercise (for example, jog, bicycle, play sports) in my community.</td>
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</tr>
<tr>
<td>A large selection of fresh fruits and vegetables is available in my community.</td>
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</tr>
<tr>
<td>The fresh fruits and vegetables in my community are of high quality.</td>
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<tr>
<td>A large selection of low fat products is available in my community.</td>
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<tr>
<td>I feel safe walking in my community.</td>
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<tr>
<td>Violence is not a problem in my community.</td>
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<tr>
<td>My community is safe from crime.</td>
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<tr>
<td>People around here are willing to help their neighbors.</td>
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<tr>
<td>People in my community can be trusted.</td>
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<tr>
<td>People in my community share the same values.</td>
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</tbody>
</table>
The following questions are about the fruits and vegetables you ate or drank during the **past 30 days**.

Please think about all forms of fruits and vegetables including cooked or raw, fresh, frozen or canned.

Please think about all meals, snacks, and food consumed at home and away from home.

Check the box that best represents your consumption of fruits and vegetables. Mo = month and wk = week

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>1-3/mo</th>
<th>1/wk</th>
<th>2/wk</th>
<th>3/wk</th>
<th>4/wk</th>
<th>5/wk</th>
<th>1/day</th>
<th>2/day</th>
<th>3/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>During the past month, how many times per day, week or month did you drink 100% PURE fruit juices? Do not include fruit-flavored drinks with added sugar or fruit juice you made at home and added sugar to. Only include 100% juice.</td>
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</tr>
<tr>
<td>During the past month, not counting juice, how many times per day, week, or month did you eat fruit? Count fresh, frozen, or canned fruit.</td>
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</tr>
<tr>
<td>During the past month, how many times per day, week, or month did you eat cooked or canned beans, such as refried, baked, black, garbanzo beans, beans in soup, soybeans, edamame, tofu or lentils. Do NOT include long green beans.</td>
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</tr>
<tr>
<td>During the past month, how many times per day, week, or month did you eat dark green vegetables such as broccoli or dark leafy greens including romaine, chard, collard greens or spinach?</td>
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<tr>
<td>During the past month, how many times per day, week, or month did you eat orange-colored vegetables such as sweet potatoes, pumpkin, winter squash, orange sweet peppers, or carrots?</td>
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</tbody>
</table>
Not counting what you just reported regarding vegetable consumption, during the past month, about how many times per day, week, or month did you eat OTHER vegetables? Examples of other vegetables include tomatoes, tomato juice or V-8 juice, corn, eggplant, peas, lettuce, cabbage, and white potatoes that are not fried such as baked or mashed potatoes.

|   |   |   |   |   |   |   |   |   |   |

**Self-reported Health Condition**

Please circle all of the following condition(s) that apply to you. Has a doctor, nurse or healthcare provider EVER told you that you have/had:

- Heart attack
- Coronary heart disease
- Stroke
- Asthma
- Skin Cancer
- Other types of Cancer
- Chronic Obstructive Pulmonary Disorder
- Emphysema
- Bronchitis
- Arthritis
- Gout
- Lupus
- Diabetes

**Demographics**

- How old are you: ______________?
- How much do you weigh__________________?
- How tall are you__________________?
- Gender: Male Female
- What is the highest level of education completed? (circle your answer)
  - Less than a high school degree
  - High school degree or equivalent
  - Some college but no degree
  - Vocational/Technical degree
<table>
<thead>
<tr>
<th>Associate degree</th>
<th>Bachelor degree</th>
<th>Graduate or Professional degree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Would you describe the place where you live as:</td>
<td>Urban</td>
<td>Suburban</td>
</tr>
<tr>
<td>Zip code of where you live:</td>
<td>______________</td>
<td></td>
</tr>
</tbody>
</table>
### Appendix B: Mean Score for each item of EHEP Questionnaire

<table>
<thead>
<tr>
<th>Environmental Health and Nutrition Survey</th>
<th>Mean ± Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pollution Sensitivity Scale</strong></td>
<td></td>
</tr>
<tr>
<td>Asbestos in buildings</td>
<td>5.65 ± 2.39</td>
</tr>
<tr>
<td>Toxic places like abandoned factories or dumps</td>
<td>7.15 ± 2.56</td>
</tr>
<tr>
<td>Improper disposal of garbage or hazardous waste</td>
<td>7.75 ± 2.29</td>
</tr>
<tr>
<td>Chemicals in rugs, furniture, and car upholstery</td>
<td>4.75 ± 2.07</td>
</tr>
<tr>
<td>Pesticides- insect sprays, lawn chemicals, etc.</td>
<td>5.35 ± 2.11</td>
</tr>
<tr>
<td><strong>Mold in buildings</strong></td>
<td>6.85 ± 1.93</td>
</tr>
<tr>
<td>Radiation from nuclear power plants</td>
<td>0.75 ± 2.31</td>
</tr>
<tr>
<td><strong>Contaminated drinking water</strong></td>
<td>8.35 ± 3.96</td>
</tr>
<tr>
<td>Pesticides, hormones, antibiotics in our food</td>
<td>6.60 ± 2.54</td>
</tr>
<tr>
<td><strong>Polluted rivers, harbors, lakes, or ocean</strong></td>
<td>8.15 ± 1.79</td>
</tr>
<tr>
<td>Air pollution from factories and power plants</td>
<td>4.00 ± 3.28</td>
</tr>
<tr>
<td>Lead from peeling paint</td>
<td>5.55 ± 2.19</td>
</tr>
<tr>
<td>Animal-waste-pet droppings, farm animal manure</td>
<td>3.55 ± 1.79</td>
</tr>
<tr>
<td>Air pollution from trucks, buses, and cars</td>
<td>4.95 ± 2.33</td>
</tr>
<tr>
<td>Chemicals in food and beverage containers, such as cans and plastic bottles</td>
<td>5.90 ± 2.07</td>
</tr>
<tr>
<td>PCBs from landfills or from discarded electrical equipment getting into water and food</td>
<td>5.74 ± 2.47</td>
</tr>
<tr>
<td>Contaminants such as pesticides in fruits and vegetables</td>
<td>5.45 ± 2.46</td>
</tr>
<tr>
<td>Contaminants like mercury, dioxin or PCBs in fish, meat or poultry</td>
<td>5.42 ± 2.69</td>
</tr>
<tr>
<td><strong>Pollution Causes Illness Scale</strong></td>
<td></td>
</tr>
<tr>
<td>When people get sick, it is often because of pollution in the environment</td>
<td>6.10 ± 2.67</td>
</tr>
<tr>
<td>The mental development of children is harmed by toxins in the environment</td>
<td>7.00 ± 2.77</td>
</tr>
<tr>
<td><strong>Many people in my community have health issues because of the pollution</strong></td>
<td>7.20 ± 2.19</td>
</tr>
<tr>
<td>The air in my community looks or smells polluted.</td>
<td>3.21 ± 2.25</td>
</tr>
<tr>
<td>Most cancer is caused by pollution in the environment</td>
<td>5.79 ± 2.27</td>
</tr>
<tr>
<td><strong>The drinking water in my community causes health issues</strong></td>
<td>7.11 ± 3.30</td>
</tr>
<tr>
<td>People who work with chemical often get sick from it</td>
<td>7.74 ± 2.51</td>
</tr>
<tr>
<td><strong>Asthma is made worse by pollution in the air</strong></td>
<td>8.05 ± 2.50</td>
</tr>
<tr>
<td>Statement</td>
<td>Score</td>
</tr>
<tr>
<td>----------------------------------------------------------------------------------------------------</td>
<td>---------</td>
</tr>
<tr>
<td>Some schools in my community are contaminated and unhealthy</td>
<td>6.42 ± 2.41</td>
</tr>
<tr>
<td>The environment where I work might hurt my health</td>
<td>3.74 ± 2.94</td>
</tr>
<tr>
<td><strong>People should worry about toxic things in their homes</strong></td>
<td><strong>7.15 ± 2.68</strong></td>
</tr>
<tr>
<td>I spend time worrying about pollution being bad for my health</td>
<td>6.15 ± 2.78</td>
</tr>
<tr>
<td>People may get sick because they don’t eat the right foods to protect themselves from pollution</td>
<td>6.11 ± 3.09</td>
</tr>
<tr>
<td>Pollution Acceptance Scale is scored 0 to 10, 0 being “disagree completely” and 10 being “agree completely”</td>
<td><strong>2.32 ± 1.77</strong></td>
</tr>
<tr>
<td>Pollution is just a part of modern life, so we can’t do much about it</td>
<td>1.88 ± 2.39</td>
</tr>
<tr>
<td>I don’t consider environmental issues nearly as important as other issues in my family or community</td>
<td>2.43 ± 2.30</td>
</tr>
<tr>
<td>I am too busy to do anything about how the environment affects health</td>
<td>2.23 ± 2.51</td>
</tr>
<tr>
<td>People don’t need to worry about toxic things, because our bodies can overcome the toxins</td>
<td>1.73 ± 2.44</td>
</tr>
<tr>
<td>People often exaggerate the amount of sickness caused by pollution</td>
<td>1.93 ± 2.05</td>
</tr>
<tr>
<td>Many people I know don’t seem to get sick, even though they don’t try to keep contaminants out of their food.</td>
<td>3.45 ± 2.84</td>
</tr>
<tr>
<td><strong>If you want to eat a normal diet, you can’t spend any time worrying about contaminants in your food</strong></td>
<td><strong>1.93 ± 2.56</strong></td>
</tr>
<tr>
<td>Eating a healthy diet will not make a difference in my health if I live near pollution</td>
<td>3.13 ± 2.89</td>
</tr>
<tr>
<td>Personal Environmental Action Scale is scored 0 to 10, 0 being “never do this” and 10 being “always do this”</td>
<td><strong>6.35 ± 1.44</strong></td>
</tr>
<tr>
<td>I stay away from a place if I think the air will be especially dirty there.</td>
<td>6.35 ± 2.85</td>
</tr>
<tr>
<td>To keep out bad air, I close my windows.</td>
<td>3.20 ± 2.88</td>
</tr>
<tr>
<td>I drink water that is bottled or filtered - not just from a faucet.</td>
<td><strong>8.65 ± 2.18</strong></td>
</tr>
<tr>
<td>I avoid being around people who are smoking.</td>
<td>7.15 ± 3.17</td>
</tr>
<tr>
<td>I avoid using insect sprays and pesticides because they could make people sick.</td>
<td><strong>7.65 ± 2.62</strong></td>
</tr>
<tr>
<td>I limit how much fish I eat because fish might contain toxic chemicals</td>
<td>4.50 ± 2.50</td>
</tr>
<tr>
<td>I talk to my doctor or nurse about how to reduce the effects of pollution on my health.</td>
<td>2.30 ± 2.79</td>
</tr>
<tr>
<td>I pick up trash that I see in the street or around my community.</td>
<td>6.90 ± 2.67</td>
</tr>
</tbody>
</table>
I do what is necessary to make sure my home is free of toxins, like lead and radon.  

7.05 ± 3.17  

I eat healthy foods to make up for the effects of pollution.  

6.15 ± 3.03  

I wash my fruits and vegetables thoroughly before using them.  

8.20 ± 1.58  

I try to eat 5 or more servings of fruits and vegetables every day.  

7.80 ± 2.48  

I eat organically grown food as much as I can.  

6.95 ± 2.41  

Community Environmental Action Scale is scored 0 to 10, 0 being “never do this” and 10 being “always do this”  

**COMMUNITY ENVIRONMENTAL ACTION SCALE**  

6.84 ± 1.38  

I join with other is trying to keep polluting businesses out of our community.  

6.38 ± 3.12  

I attend meetings about environmental health issues in my community  

7.33 ± 2.12  

When something is polluting our community, my neighbors and I get it stopped  

4.28 ± 2.34  

I tell others about how the environment can affect health.  

7.03 ± 1.91  

I talk with my friends and neighbor about how we can get healthier foods in our town.  

8.43 ± 1.73  

I talk with my friends and neighbors about how we can get cleaner in our town.  

7.63 ± 2.63  

Top 5 indicators in each category are bolded. Italicized are nutrition related indicators.
Sources


24. Kentucky Department for Public Health (KDPH) and the Centers for Disease Control and Prevention (CDC). Kentucky Behavioral Risk Factor Survey
(KyBRFS) Data. Frankfort, Kentucky: Cabinet for Health and Family Services, Kentucky Department for Public Health, [2014].

25. Kentucky Department for Public Health (KDPH) and the Centers for Disease Control and Prevention (CDC). Kentucky Behavioral Risk Factor Survey (KyBRFS) Data. Frankfort, Kentucky: Cabinet for Health and Family Services, Kentucky Department for Public Health, [2017].


Vita

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