Introduction

Mold Dose-Response Assessment

Risk Characterization

Overview of Risk

Mold and dampness are known risk factors for childhood asthma that is linked by evidence from multiple epidemiological studies (Calafat et al., 2016; Garnett et al., 2019; Mekkel et al., 2011; Rosen, 2015). The association between indoor mold and childhood asthma cannot be overlooked.

Risks for Minority Children in Urban Areas

Exposure Assessment

Molds and dampness are often the cause of mold growth and moisture in the urban environment, according to the 2016 American Housing Survey. Children with asthma are more likely to live in neighborhoods with mold and related dampness problems. However, mold prevalence and related dampness problems are more common in low-income households with rental properties than in single-family homes with owners who are not low-income renters. The prevalence of mold and dampness in urban areas is higher than in rural areas.

Risk Management & Recommendations

Prevention and Removal of Mold

Homes and real-estate transactions should not be conducted without mold testing and remediation. Removal of mold and related dampness problems is essential for healthy living. EPA recommends that mold be removed from buildings and homes as soon as possible.

Public Health Recommendations

Urban areas can rapidly develop mold, allergens, and other irritants that may cause respiratory problems. Public health officials and community leaders should collaborate to develop strategies to reduce mold and dampness in urban areas.

References

Comparing Source-Specific PM$_{2.5}$ Between Rush Hour vs. Sporadic Commuters
Charlotte Joannidis, Jenna R. Krall, Karlin D. Moore – Department of Global and Community Health – George Mason University

**Objectives & Methods**

**Objectives:** To cluster commuters by type and to identify associations with increased tr-PM$_{2.5}$ exposure

**Methods:**
- Commute data consisted of uncontrolled personal vehicle trips of 45 commuters in the Washington, D.C. metro area over 48 hours, with a total of 320 trips.
- Commuter types were identified using sparse k-means clustering.
- Source-specific PM$_{2.5}$ was estimated using Positive Matrix Factorization.
- Linear regression was used to estimate differences in source-specific PM$_{2.5}$ by commute cluster.

**Figures**

**Figure 1:** Average minutes spent in-vehicle for each hour of the day per participant, with participants grouped by cluster.

**Figure 2:** Differences in source-specific PM$_{2.5}$ in log mg/m$^3$ (95% confidence intervals) between rush hour and sporadic commuters using linear models without adjustment (Unadjusted) as well as adjusted for residential PM$_{2.5}$ from 12 a.m. to 4 a.m. (PMNight).

**Introduction**

- tr-PM$_{2.5}$ has been associated with adverse health outcomes such as cardiovascular mortality and morbidity.
- In-vehicle tr-PM$_{2.5}$ exposure contributes to total personal pollution exposure.
- Trip characteristics, such as time of day, day of the week, and traffic congestion, are associated with increased in-vehicle PM$_{2.5}$ exposures.

**Results**

- Clusters 1-3 were combined to create two commuter clusters: rush hour commuters (primarily traveled during rush hour) and sporadic commuters (travelled throughout the day) (Figure 2)
- Integrated Black carbon (BC) was higher for rush hour commuters (median = 1.1 µg/m$^3$ (IQR = 1.53)) compared to sporadic commuters (2.0 µg/m$^3$ (IQR = 1.9)).
- Mixed mobile PM$_{2.5}$, consisting primarily of tailpipe emissions and brake/tire wear, was higher for rush hour commuters (2.9 µg/m$^3$ (IQR = 2.4)) compared to sporadic commuters (2.1 µg/m$^3$ (IQR = 2.4)), though this difference was not statistically significant (Figure 3).

**Discussion/Conclusions**

- This study's unique aspect identifies the association of commuter characteristics with pollution through clustering commuter types with sparse K-means.
- Mixed mobile PM$_{2.5}$ and integrated BC were higher for rush hour commuters compared to sporadic commuters.

**Acknowledgements**

Special thanks to Dr. and Dr. for their guidance throughout the project and to my three mentors, Dr. Karlin for her support and collaboration. This project was supported by the Training Grant from George Mason University and the Thomas F. and Kate M. Levit Fellowship Trust, Bank of America, Trustee.

**References**

Exploration of the Spatial Relationships between Lead and Pesticide Exposures and Neurodegenerative Disease Age-Adjusted Mortality Risk in North Carolina

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**Introduction & Data**

Neurodegenerative diseases, Parkinson’s disease, Alzheimer’s disease, & Amyotrophic Lateral Sclerosis (ALS), are progressive disorders that affect the motor neurons of the brain and spinal cord. Genetics accounts for a small to moderate portion of causal factors, but the rest is left to be explained by environmental toxins.

1. Combine the three neurodegenerative diseases to look for clusters.
2. What is the strength of the relationship between all three diseases and exposure to lead and paraquat?

Data is provided by CDC Wonder, NC Vital statistics, US Census Bureau, State Center for Health Statistics Childhood Lead Poisoning Prevention Program, and Pesticide National Synthesis Project.

**Lead Exposure**

Children are exposed by ingesting lead paint from a home or from a parent due to an occupational hazard. Exposure to pesticides, in conjunction with lead, led to a severe increase in risk for neurodegenerative disease development by at least 50 percent (Gunnarson & Bodin, 2019).

**Neurodegenerative Diseases**

Spatial autocorrelation is confirmed with a Moran’s I value of 0.418 at 0.0 sig. level, meaning the pattern within the data is not random.

![North Carolina Neurodegenerative Age-Adjusted Mortality Risk 2008-2017](image)

**Pesticide Exposure**

Pesticides are chemicals used on plants or crops to kill insects, weeds, rofants, bacteria, or fungi. The herbicide paraquat is used by farmers.

![North Carolina Pesticide Use Low Estimates 2008-2017](image)

The research considers occupational, chronic lead exposure in adults, but needs original data from the CDCABLES Program to add to the analysis.

**Neurodegenerative Disease Clustering**

The bright red area indicates neurodegenerative disease clustering, warranting further investigation.

![North Carolina Neurodegenerative Hot Spots 2008-2017](image)

**Results & Conclusions**

![North Carolina Neurodegenerative Age-Adjusted Mortality Risk 2008-2017](image)

Linear Regression Analysis - Lead Adjusted R Squared: 0.045 at 8.018 sig. level (p<.05)
Order Least squares Regression - Lead and Paraquat Adjusted R Squared: 0.054 at .026 sig. level (p<.05)

The results successfully explained 5.4% of the variation in neurodegenerative disease age-adjusted mortality risk by exposure to lead and paraquat.
Evaluating the Impact of Work Environments on ADHD Presentation in Adults

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Introduction

Four out of every one-hundred American adults live with Attention-Deficit/Hyperactivity Disorder, or ADHD. ADHD is a neurodevelopmental disorder characterized by continuous, disruptive patterns of inattention and/or hyperactivity. Compared to those in children, ADHD symptoms in adults present differently, as restlessness and impulsivity are often internalized. Even so, ADHD negatively affects work and educational outcomes, as well as personal life decisions. Total Worker Health (TWH) initiatives are policies and programs that advocate for worker health by protecting from work hazards and promoting health and injury prevention. TWH recognizes that work is a social determinant of health and that any positive change in work environments or conditions can improve overall health. The purpose of this study was to determine how occupational settings impact the mental health and behavior of workers with ADHD, in order to improve their overall health and success.

Methodology

A risk assessment was conducted following the Environmental Protection Agency’s (EPA) human health risk assessment process. This method is depicted in Figure 1. Information and data utilized in the risk assessment was obtained through a review of existing literature. Articles and studies were found by searching “adult” adults, “occupational environment,” and “manifestation of ADHD” in Google Scholar and the National Institute of Health’s PubMed database. Searches were restricted to sources from 2010 - 2020. Sources were restricted to free-access and subscriptions obtained through the University of Lynchburg.

Findings

Environments that find symptoms of inattention, restlessness, impulsivity, and distractibility pose a unique hazard to ADHD-burdened workers. These symptoms manifest in many ways, as depicted in Figure 2.

Risk Characterization

ADHD adult workers may be at increased risk of experiencing negative health effects from some occupational environments. Sedentariness increases restlessness in ADHD adults, which can lead to poor work performance and/or job loss. Long-term sedentary behavior can contribute to the development of mental illness, many of which ADHD individuals are predisposed to. Workers with ADHD have a difficult time attending to daily tasks and completing routine tasks under time-limited conditions. Difficulties accomplishing these tasks may result in a worker’s risk for burnout. Work environments impact psychological health and work engagement. Work engagement is directly related to productivity. Distraction, attributed to boredom and irritability, decrease mood and increase irritability. This can lead to personal distress, substance abuse, and occupational accidents.

Risk Management & Recommendations

Sedentary behavior should be interrupted every 20-30 minutes by switching tasks or moving to a standing position. Giving workers more control over their job can reduce stress and burnout. Counseling can teach workers better organizational techniques and habits that counter their ADHD symptoms. Headphone and optimizing workspaces can reduce distractions and improve mental stimulation. Finally, Total Worker Health policies should be implemented in all workplaces to improve worker health, safety, and productivity.

References

2. CDC. (2018). Symptoms and Diagnosis of ADHD.
5. EPS. 2017. Conducting a Total Worker Health Risk Assessment.
13. ATSDR. 2013. Attention Deficit Hyperactivity Disorder.
Outdoor Air Pollution and Cancer in African American Men
Megan Coles, MPH Candidate
University of Lynchburg

Introduction & Purpose
African American men have the highest death rate and the lowest survival rate for most cancers (Desantis et al., 2013). Some of the highest cancer death rates in the US are found in Louisiana. Outdoor air pollution and particulate matter is considered carcinogenic to humans and has been linked to lung, bladder, and kidney cancer (Turner et al., 2017). The purpose of this literature review was to investigate the relationship between outdoor air pollution and increased incidence of cancer in African American men.

Methodology
A literature review was conducted using Pubmed and Google Scholar to search for peer-reviewed articles. Key terms were: Residential Segregation, Discrimination, African American Men, Cancer, Outdoor Air Pollution. A total of 14 articles were reviewed using the EPA’s Risk Assessment Process.

Findings: Dose-Response Assessment
Outdoor particulate matter can come from many different primary and secondary sources such as industrial processes, vehicles and coal-fired power plants. Factors such as exposure duration and individuals’ susceptibility to other diseases determine how harmful outdoor air pollution will be. Studies have shown that there is a 9% increase in risk for lung cancer per 10 μg/m3 increase in PM2.5 concentrations in the outdoor air and an 8% increase in risk for lung cancer per 10 μg/m3 increase in PM10 in the outdoor air (Turner et al., 2010). Studies have also shown that chronic exposure to air pollution is associated with increased CVD risk and mortality (Erondu et al., 2018).

Findings: Exposure Assessment
A study conducted by Kravitz-Wirtz et al. (2016) found that Black and Latino neighborhoods had concentrations of PM2.5 and PM10 that were between 7% and 32% higher than in White neighborhoods. A study by Erondu et al. (2018) found that African Americans had significantly higher exposures to air pollutants in a community-based cohort of adults in Western Pennsylvania. African Americans tend to live in areas with greater exposure to air pollution due to decades of residential segregation (American Lung Association, 2020).

Findings: Hazard Identification
Industrial factories are located near low income and minority communities, which may lead to disproportionate health effects for residents due to air toxics (James et al., 2012). The communities in these areas are also predominantly African American (Terrell & James, 2021). High cancer rates among African American men in Louisiana may be connected to the industrial belt referred to as “Cancer Alley.” This is an area along the Mississippi River between Baton Rouge and New Orleans, which contains numerous industrial plants near predominately Black communities.

Conclusion & Risk Characterization
Black communities and African American men are disproportionately affected by outdoor air pollution and cancer and is linked to residential segregation and increased risk for exposure to industrial plants and factories. According to Baucke et al. (2019), new industrial plants are being planned for the industrial belt in the Baton Rouge area of Louisiana. Many companies locate their plants and factories in disadvantaged areas because the residents do not have the political power to oppose their placement. Since these residents lack political power, they lack advocates in fairways representing them at the national level (James et al., 2012). Predominantly black and poor communities also deal with other social issues such as crime, drugs, and poverty. Because of this, the community residents aren’t only focused on environmental issues. Residents of these communities cannot easily relocate due to economic, educational, and social barriers (James et al., 2012); thus, continuing their exposure to outdoor air pollution and increased risk for cancer.

Risk Management & Recommendations
- Prevent industrial factories from being built in the industrial belt of Louisiana and near other predominately Black communities
- Create stricter air pollution standards for industrial facilities
- Encourage residents to limit time outdoors when pollution levels are elevated (Laubach, 2010)
- Encourage citizen involvement in environmental policy
- Create more mixed income communities (Rice et al., 2014).

References
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Particulate Matter Concentration Around Lamberts Point & Railroad, Norfolk, VA
Shobha Subedi
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Introduction

Particulate Matter (PM) is a mixture of microscopic solid or liquid particles suspended in the atmosphere. According to Norfolk Southern, the Lamberts Point coal terminal located on the eastern shore of Elizabeth River has an annual capacity of up to 3.8 million tons of coal transloading. Continuous loading, dumping, and ship loading of thousands of tons of coal occur from trains to ships at this location. This process leads to the emission of coal dust into the environment. These microscopic dust particles in the atmosphere can be inhaled during respiration and impact respiratory health. The main objective of the air sampling was to monitor the PM concentration in the community around the coal terminal and find if PM concentration levels were within the EPA regulations.

Equipment and Procedure

- 10 sampling sites were selected within the community and in close proximity to the coal loading area (to monitor coal dust emissions in the surroundings).
- Study Duration: 4 months (June-October, 2018)
- Sampling: Continuous measurements once per day
- Data collection: Between 0:00 am and 3:00 pm, 4-hours or 8-hours shift
- Each site was monitored at intervals for data accuracy.

Table 1: Location

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<th>No</th>
<th>Site</th>
<th>Pollutant Source</th>
<th>Location</th>
<th>Longitude</th>
<th>Latitude</th>
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<tr>
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<tr>
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<tr>
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<tr>
<td>7</td>
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<td>Community</td>
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<td>-76.315000</td>
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</table>

Table 2: EPA National Air Quality Standards for Particulate Matter

<table>
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<tr>
<th>Pollutant Type</th>
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<th>Annual Average Level</th>
<th>Annual Average Time Period</th>
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<td>Primary</td>
<td>12 μg/m³</td>
<td>24 hours</td>
</tr>
<tr>
<td></td>
<td>Secondary</td>
<td>15 μg/m³</td>
<td>24 hours</td>
</tr>
</tbody>
</table>

Conclusion

- PM<sub>2.5</sub> 24-hour average regulation levels for PM<sub>2.5</sub> and PM<sub>10</sub> were not exceeded by any of the above sites.
- PM<sub>2.5</sub> ranged from (0.40-1.25) μg/m³ and PM<sub>10</sub> ranged from (1.30-12.25) μg/m³.
- Site B showed the highest PM concentration during traffic rush hours in Hampton Blvd.
- Site D showed continuous changes in the PM<sub>2.5</sub> concentration. The site is within 25 feet of railroad tracks. The fluctuation in PM<sub>2.5</sub> concentration throughout the day shows need for regular air quality monitoring along with the track of movement of the coal trains around the location.

Further Suggestions

- Increase number of sampling sites.
- Monitor throughout the year for annual average PM concentration and effect of weather on PM concentration.
- Record keeping of the coal transportation time and PM concentration analysis is suggested to determine the association between coal transportation and PM concentration near railroad tracks and coal storage location.

I would like to thank my faculty advisor Dr. Anna Ang for her prudence and air sampling project. The project would not be complete without the help of PM<sub>2.5</sub>, EHS, and community members who supported my project by providing access to the sampling site within and around their properties.
The Utility of Perceived Neighborhood Environments as a Predictor of Childhood Obesity
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Background
- Past research has shown that individual neighborhood environments play a role in youth weight status.
- Both food environments and physical activity environments have been considered to understand caloric balance in youth.
- Saelens et al. (2012) demonstrated that food and physical activity environments played a role in youth weight status, but the study only considered objective measures of the environment. These included GIS audits of neighborhood proximity to parks and other recreational facilities and to supermarkets and fast-food restaurants.
- By only researching objective measures of access to healthy resources, there is the potential to miss the influence of social determinants of health on youth weight status.
- Carroll-Scott et al. (2013) proposed that the utilization of perceived access to resources supporting healthy living allowed for insight into the impact of social determinants of health on youth weight status, but nutritional environments were not considered.

Purpose
The purpose of this study was to explore the relationship between perceived neighborhood physical activity environments (PPAE) and perceived food environments (PFE) on weight status in youth.

Methodology
- Perceptions of neighborhood access to physical activity and food resources, along with objective measures of BMI-for-age, were gathered from the 2017 Roanoke Valley Community Healthy Living Index.
- Responses to prompts such as “Food stores offering healthy foods are in walking/biking distance from home or are easy to get to by bus” and “Parks and other areas are available for people of all ages to be active in the neighborhood” were used to characterize code neighborhood PPAE and PFE as low or high.
- Chi-square analysis was used to analyze the relationship between joint PPAE/PFE environments and youth BMI-for-age.

Results
- Complete data was available for 574 students (age = 7.27 ± 1.77 years).
- Children who perceive they live in a low food/physical activity environment are more likely to be overweight or obese than children who perceive they live in environments with high levels of access to both resources, or some combination of high/low access ($X^2(3, N = 574) = 12.933, p = .003$, Cramer’s $V = .15$).

Conclusions
- Students that perceived that they had higher access to resources supporting physical activity and healthy eating tended to have a lower BMI-for-age.
- The magnitude of difference in obesity rates between Low PPAE/Low PFE and High PPAE/High PFE was 28%; Saelens et al. (2012) found an 8% difference between objectively measured high and low physical activity and food environments.
- Variability in the magnitude of difference could indicate that studying perceived access to resources supporting healthy living may play a better role in understanding the impact of social determinants of health on youth weight status.

Future Directions
- Our data suggests that utilizing perceived access to neighborhood healthy-living resources may provide a more robust understanding of the impact of social determinants of health on youth weight status.
- These findings indicate the usefulness of studying perceived neighborhood environments and may be used to guide localized policies to reduce youth overweight and obesity.