Background

- Asthma is the most common pediatric chronic disease affecting 6.1 million children in the United States today.
- The exact cause of asthma is unknown, but it is believed to be due to both genetic and environmental factors.
- One environmental factor associated with health is air quality which is monitored based on the National Ambient Air Quality Standards (NAAQS). Due to the complexities of the NAAQS, information about air pollution is often relayed to the public using the air quality index (AQI).
- Asthma exacerbations have been connected to air quality. However, their relationship to the child was unknown.

Methods

Data
- 2017 Selected Metropolitan/Micropolitan Area Risk Trends Behavioral Risk Factor Surveillance System (SMART: BRFSS)
- 2017 EPA Annual AQI dataset

Population
- Children 17 years and younger
- Asthma information provided by adult proxy
- Statistical area with 365 days AQI data

Variables
- Binary childhood asthma variable
- Adult respondent’s health care and education level
- AQI measurements for statistical areas:
  - Median AQI
  - 90th Percentile AQI
  - Maximum AQI

Analyses
- Bivariate analyses (chi square/two-sample t-test)
- Mixed-Effects Logistic Regression
- Controlling for adult respondent’s health care coverage and education level
- Random effect for statistical area codes

Results

After the datasets were combined, there were 89 statistical areas included in this analysis. The annual median, 90th percentile, and maximum AQI for each statistical area can be viewed on the maps below which is color coded based on the AQI scale from 0 – 500.

Bivariate Analyses

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>Children with Asthma</th>
<th>Children without Asthma</th>
<th>Test Statistic</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>1,660 (81.0%)</td>
<td>18,827 (91.0%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adult Respondent’s Healthcare Coverage</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>1,499 (95.68%)</td>
<td>16,649 (89.82%)</td>
<td>X2 = 0585</td>
<td>0.0020</td>
</tr>
<tr>
<td>No</td>
<td>154 (9.32%)</td>
<td>2,096 (10.18%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adult Respondent’s Education</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Did Not Graduate High School</td>
<td>122 (73.55%)</td>
<td>1,268 (67.4%)</td>
<td>X2 = 0.00004</td>
<td>0.5418</td>
</tr>
<tr>
<td>Graduated High School</td>
<td>405 (24.46%)</td>
<td>4,035 (21.43%)</td>
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</tr>
<tr>
<td>Attended College or Technical School</td>
<td>471 (28.37%)</td>
<td>4,978 (26.44%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Graduated College or Technical School</td>
<td>661 (39.82%)</td>
<td>8,514 (45.22%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Mean AQI Measurements

- Median AQI: 47.17 (47.78) t = -2.85 0.0045
- 90th Percentile AQI: 73.75 (75.48) t = -3.38 0.0007
- Maximum AQI: 137.8 (139.2) t = -1.41 0.1595

Multivariate Analyses

The final mixed-effects logistic regression was done three times to evaluate the OR (95% CI) for each AQI measurement:
- Median AQI: OR = 0.995 (0.987, 1.003)
- 90th Percentile AQI: OR = 0.997 (0.993, 1.001)
- Maximum AQI: OR = 0.999 (0.997, 1.001)

Discussion

Overall, this study found there was no association between childhood asthma prevalence and annual AQI data in urban areas in the United States. The study did find an association between childhood asthma prevalence and the adult respondent’s health care and education level. There were, however, many limitations to this study. Therefore, additional studies are needed to determine if individual air pollution exposure is associated with childhood asthma.

Limitations

- An adult proxy provided information about a child’s asthma, however, their relationship to the child was unknown.
- Adults may have incorrectly answered the asthma questions on the SMART BRFSS survey.
- The dataset did not contain basic demographics for the child.
- AQI data is based on a single pollutant each day. It does not account for the cumulative effects of air pollutants.
- The median and 90th percentile AQI in the statistical areas were primarily less than 100 (yellow or green) which is considered satisfactory air quality in the United States.
- AQI data was based on the entire statistical area. It did not account for individual air pollution exposure.

Acknowledgements

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*References available on request