

**Indicator Template**  
**Content Area: Asthma**  
**Indicator: Emergency Department Visits for Asthma**  
Environmental Public Health Tracking  
August 2021

<b>Type of EPHT Indicator</b>	Health outcome
<b>Measures</b>	<ol style="list-style-type: none"> <li>1. Number of Emergency Department Visits for Asthma</li> <li>2. Crude Rate of Emergency Department Visits for Asthma per 10,000 Population</li> <li>3. Age-adjusted Rate of Emergency Department Visits for Asthma per 10,000 Population</li> </ol> <p>Measures use the following combinations of geographic boundaries and temporal aggregation:</p> <ul style="list-style-type: none"> <li>• Census tract, 5-year period</li> <li>• 5,000 Minimum Person Population Area, 3-year period</li> <li>• 20,000 Minimum Person Population Area, 1-year period</li> <li>• County, 1-year period</li> <li>• State, 1-year period</li> </ul>
<b>Derivation of Measure(s)</b>	<p><i>Numerator:</i></p> <ul style="list-style-type: none"> <li>• Emergency department (ED) visits during a calendar year for asthma using International Classification of Diseases, Ninth Revision, Clinical Modification code (ICD-9-CM) 493 or International Classification of Diseases, Tenth Revision, Clinical Modification code (ICD-10-CM) J45 as the primary diagnosis code (including records for ED visits resulting in a hospitalization)</li> <li>• Both inpatient and outpatient records with duplicate* records removed and transfers to other hospitals included.</li> </ul> <p>*Duplicate records refer to more than one record for the same person for the same event (with the same ED visit data e.g., sex, date of birth, admission/ED visit date, and ZIP code have exact same information).</p> <p><i>Denominator:</i></p> <ul style="list-style-type: none"> <li>• Annual population estimates for state, county, and census tract from U.S. Census Bureau</li> </ul> <p><i>Adjustment:</i></p> <ul style="list-style-type: none"> <li>• Age-adjustment by the direct method using Year 2000 U.S. Standard population</li> </ul>
<b>Unit</b>	<ol style="list-style-type: none"> <li>1. Age-adjusted rate per 10,000 population</li> <li>2. Rate per 10,000 population</li> <li>3. Number</li> </ol>

<b>Geographic Scope</b>	State and county
<b>Geographic Scale</b>	Residents of jurisdiction – census tract, 5,000 minimum population area, 20,000 minimum population area, county, combined counties, and/or state
<b>Time Period</b>	ED visits with admission dates from January 1 through December 31, inclusive, for each year 2000 – most recent complete year available
<b>Time Scale</b>	Annual, 3-year period, or 5-year period
<b>Rationale</b>	<p>Asthma continues to be a serious public health problem. It is a leading chronic health condition among children, and more than 25.1 million people, including 5.1 million children (0-17 years), had asthma in 2019.<sup>1</sup> In 2018, there were 178,530 hospitalizations and 1.6 million ED visits for asthma.<sup>2</sup> Asthma is a leading chronic health condition among non-Hispanic black persons. Statistics show that in 2016, the asthma death rate was 2.8 times greater among Blacks than Whites<sup>3</sup></p> <p>According to a 2013 CDC AsthmaStats report, approximately 13.8 million missed school days were reported due to asthma.<sup>4</sup> Despite the availability of effective prevention measures, asthma-associated costs are increasing. From 2008-2013, the total annual cost of asthma in the U.S., including medical care, absenteeism, and mortality, was \$81.9 billion.<sup>5</sup> For that same period, there was an annual per person medical cost of asthma of approximately \$3,300 each year.<sup>5</sup> Estimated direct costs of asthma in adolescents and adults in the United States during the next 20 years is likely to be over \$1.5 trillion. During this 20-year period, there will be 175 million person-years of uncontrolled asthma.<sup>6</sup></p> <p>Associations between environmental exposures and asthma have been consistently demonstrated.<sup>7,8,9,10</sup> Many outdoor air pollutants have been associated with increased asthma ED visits.<sup>11,12,13,14,15</sup> There is strong scientific evidence for direct associations between increased ozone concentrations and increases in asthma ED visits in children and adults.<sup>12,13</sup> In one study, asthma ED visits increased by 33% when daily 1-hour maximum ozone concentration exceeded 75 ppb;<sup>10</sup> another study reported a 26% increase in ED visits when the daytime mean ozone concentration exceeded 60ppb.<sup>11</sup> Associations between asthma-related ED visits and ambient air particulate matter—both PM<sub>10</sub> and PM<sub>2.5</sub>—have been repeatedly observed and are especially robust for children.<sup>13,14</sup> Other pollutants such as carbon monoxide (CO), nitrogen dioxide (NO<sub>2</sub>), and pollution from automobiles, coal, and petrochemical sources<sup>15,16</sup> were also associated with higher asthma ED visits. Other outdoor environmental triggers for asthma ED visits in children include pollen and ambient temperature. Increased asthma ED visits have also been associated with environmental tobacco smoke.<sup>17</sup></p> <p>CDC's Tracking Program developed sub-county geographies based on having a minimum population threshold of 5,000 and 20,000 persons. For data prior to 2020, these populations are based on population data of the 2010 Decennial Census. After the 2020 Decennial Census data is available, sub-county geographies will be aggregated based on the population of the Decennial Census for that decade, with health data reported during that decade using the corresponding geographies. The</p>

	<p>5,000-person minimum population geographies are created by aggregating census tracts by block group population-weighted centroids until the minimum population threshold is achieved. The 20,000-person minimum population areas are created by aggregating the 5,000-person minimum population areas by census tract population-weighted centroids until the minimum population threshold is achieved. These two sets of geographies also contain areas of combined counties. Where possible, counties below the desired minimum population are combined with neighboring counties also below the desired minimum population until the minimum population threshold is achieved. Where not possible, these counties are left as independent counties. Census tracts with zero population are not included in the described aggregations methods and remain as zero population census tracts. By using these geographies to display health data, the Tracking Program can provide statistically stable health information for smaller communities than standard county-level data can provide, while protecting confidentiality of the residents of these geographies that census tract-level health data may have challenges with.<sup>18</sup> <a href="#">For detailed information on the Tracking Program's aggregation methodology, please visit our GitHub repository.</a></p>
<b>Use of the Measure</b>	<p>The development of a single analytic method for asthma ED visits among persons living in state will inform multiple users:</p> <p><i>State:</i></p> <ul style="list-style-type: none"> <li>• May be linked with other risk factors, such as air pollution, to identify susceptible populations and explore ecological relationships.</li> <li>• Allows for a better understanding of characteristics of ED visits and identify disproportionally affected areas. Permits the monitoring of trends temporally and spatially.</li> </ul> <p><i>National:</i></p> <ul style="list-style-type: none"> <li>• It will allow for comparison across states, which can be used to target interventions (especially for CDC and EPA).</li> </ul> <p><i>Public:</i></p> <ul style="list-style-type: none"> <li>• The public and concerned community members will be able to view the Tracking Network webpage and learn the annual rate of asthma ED visits and burden of asthma in their state, county, or sub-county areas.</li> </ul>
<b>Limitations of the Measure</b>	<ul style="list-style-type: none"> <li>• Numbers may be too small in rural areas to calculate stable rates.</li> <li>• The timing of the exposure may not correspond to the timing of the asthma exacerbation leading to the ED visit.</li> <li>• Individuals may have asthma exacerbations due to exposure to an environmental risk factor that does not result in an ED visit and thus, are not captured in this measure.</li> <li>• Reporting rates at the state and/or county level may not represent the true asthma burden at more local areas such as inner-city or neighborhood.</li> <li>• Reporting rates at the state and/or county level may not have sufficient geographic resolution to be linked with many types of environmental data.</li> </ul>

	<ul style="list-style-type: none"> <li>• When looking at small geographic levels (e.g., sub-county, ZIP code), users must take into consideration appropriate cell suppression rules imposed by the data providers or individual state programs.</li> <li>• Although duplicate records for the same ED visit are excluded, the measures are based upon events, not individuals, because no unique identifier is always available. When multiple admissions for the same person during the year are not identified, the resulting rate is not the proportion of the population that has an asthma ED visit. Rather, it is the number of events per 10,000 population, which is an overestimate of the proportion. Even at the county level, it can be expected that the measures generated will often be based upon numbers too small to report or present without violating state and federal privacy guidelines and regulations. Careful adherence to cell suppression rules in cross tabulations is necessary and methods to increase cell sizes by combining data across time (e.g., months, years) and geographic areas may be appropriate.</li> <li>• The Tracking Program's sub-county geographies are created using populations of United States Decennial Census. Measures towards the end of the decade may be less reliable as population shift occurs.</li> <li>• Limitations associated with the sub-county aggregation methodology are described in <a href="#">our GitHub repository</a>.</li> </ul>
<b>Data Sources</b>	<p><i>Numerator:</i> State ED data</p> <p><i>Denominator:</i> U.S. Census Bureau population data</p>
<b>Limitations of Data Sources</b>	<p><i>State ED data:</i></p> <ul style="list-style-type: none"> <li>• Federal institutions, such as Veteran's Affairs, Indian Health Services, and prison facilities, are excluded from the data.</li> <li>• In-state residents who visit an ED in surrounding states would not be included unless states have ED data sharing agreements.</li> <li>• Practice patterns and payment mechanisms may affect diagnostic coding and decisions by healthcare providers.</li> <li>• Sometimes the mailing address of a patient (e.g., PO Box) is listed as the residence address of the patient. Patients may be exposed to environmental triggers in multiple locations, but geographic information is limited to residence.</li> </ul>
<b>Related Indicators</b>	<ul style="list-style-type: none"> <li>• Asthma prevalence among adults</li> <li>• Asthma prevalence among children</li> <li>• Hospitalizations for asthma</li> </ul>
<b>References</b>	<ol style="list-style-type: none"> <li>1. Centers for Disease Control and Prevention. Most Recent National Asthma Data: National Current Asthma Prevalence 2019 [cited 2021 Jul 28] <a href="https://www.cdc.gov/asthma/most_recent_national_asthma_data.htm">https://www.cdc.gov/asthma/most_recent_national_asthma_data.htm</a></li> <li>2. Centers for Disease Control and Prevention. Healthcare Use Data 2018: Emergency Department Visits [cited 2021 Jul 28] <a href="https://www.cdc.gov/asthma/healthcare-use/2018/table_a.html">https://www.cdc.gov/asthma/healthcare-use/2018/table_a.html</a></li> <li>3. American Lung Association. Asthma Trends and Burden: Asthma Mortality [cited 2021 July 28] <a href="https://www.lung.org/research/trends-in-lung-disease/asthma-trends-brief/trends-and-burden">https://www.lung.org/research/trends-in-lung-disease/asthma-trends-brief/trends-and-burden</a></li> </ol>

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