HOW-TO GUIDE – SEHIC ASTHMA INDICATOR # C3:

ASTHMA EMERGENCY DEPARTMENT VISITS

NOTE: Many of the states funded by the Centers for Disease Control and Prevention's (CDC's) National Asthma Control Program conduct emergency department (ED) asthma surveillance. It is possible some of these programs may report asthma ED frequencies and rates for your state, as described below for this ED asthma indicator. To find the name and contact information for your State Asthma Contact go to: http://www.cdc.gov/asthma/contacts/.

Specific Measures:

1. Annual Number of ED Asthma Visits

From the statewide ED data file (from State Health Department, Hospital Association, etc.) obtain the number of ED visits that meet these criteria:

- **Visits to a hospital emergency department.** States vary in how they refer to ED visits and how the data files are compiled. For example, some states may refer to ED visits as "Ambulatory Care". Whatever the case, only include visits for asthma to a hospital ED in computing this indicator.
- **Principal (primary or first listed) discharge diagnosis of 493** (ICD-9-CM). Include all extensions of code 493, with or without periods (i.e., 493.00, 493.10…493.99 or 49300, 49310…49399).
- **State of residence=*'your state'*.**
- **Year = *calendar year* of ED visit date** (also known as service date or date of admission)

Notes:

- Exclude ED visits for:
  - Out-of-state residents or if state of residence is unknown
  - Out-of-state hospitals (even if the patient resides in-state)

- If an ED visit results in admission to the hospital:
  - The record for that visit may only be documented as an inpatient hospitalization record listing the source of the admission as the ED. To count these ED visits, obtain the corresponding inpatient hospitalization file and locate records for which the source of admission code is the ED. In the multi-state coding scheme proposed by the Healthcare Cost and Utilization Project (HCUP), "asource=1" can be used to identify admissions from the ED. (Confirm the "asource" code with your state's data dictionary, as it may vary by state.) Note that ED visits resulting in a hospital admission are also counted in the Asthma Hospitalization indicator (SEHIC Asthma Indicator #C1).

- If the data source for ED visits resulting in hospital admission is a hospital discharge file:
  - The year of the file refers to the year of discharge. Therefore, the date of discharge and the date of admission (which would also be the date of the ED visit) may not fall in the same calendar year (e.g., some cases with late December ED visit dates who are admitted may be discharged in January of the following year). In order to determine an accurate and complete count of all ED visits:

(1) Exclude cases admitted to the hospital from the ED who have an admit date in the prior year, and
(2) Include cases admitted to the hospital from the ED who have an admit date in the year of interest – this will include observations from the hospital discharge files in both the year of interest as well as the following year.

Recognizing that waiting for this second year of data to become available will diminish the timeliness of the reported indicator, a provisional indicator computation can be performed using only the discharge file from the year of interest. For a provisional computation, include all cases admitted to the hospital from the ED that appear in the hospital discharge file for the year of interest, regardless of date of admission. This approach assumes that the number of cases admitted through the ED during one calendar year and discharged from the hospital in the following calendar year remains approximately constant year-to-year. This "provisional" indicator computation step can stand in for the final results until the next year's hospital discharge file becomes available, at which point the two-step approach outlined above should be employed.

- Use data that has been de-duplicated for duplicate records (i.e., "identical" multiple records for the same visit), but not for "unique" repeat visits. A patient could have multiple "unique' ED visits during a calendar year, or even within a single day; it is important to retain all these "unique' visits in the data set as separate records. Without personal identifiers, this data source represents ED visit data and not patient data. The approach for de-duplicating data will depend on the data file structure available in your state.
    - For example, in Minnesota, database administrators release the ED dataset with the duplicates flagged but not removed. The following variables are used to flag duplicates in MN: 1) hospital code; 2) medical record number; 3) admission date; 4) discharge date; 5) date of birth; 6) sex; and, 7) zip code. When these fields are "identical" in two records, one is considered a duplicate of the other, and may be deleted.
    - However, as discussed above, a patient might have multiple "unique" ED visits on a single day, if symptoms are not adequately managed at the initial visit. If available, a time of admission variable could be used to determine whether two (or more) same-day-visit records actually represent the same visit. If no such variable exists, the analyst should consult with the agency responsible for collecting ED visit data and proceed using his/her best judgment in determining whether same-day visits with "identical" values in all selected demographic and visit-related fields should or should not be counted as duplicates, and in turn, whether or not to delete these duplicate records from the final dataset.

- In some states, ED data may be combined with outpatient visit data. Identifying ED visits in this case can be accomplished using CPT, revenue or bill type codes. If this pertains to your state, and you have questions, or you would like example codes, please contact SEHIC/CSTE.

- Data sources: In some jurisdictions, the state health department or another state agency owns and maintains the State's ED data; in others, these data are owned and managed by another entity, such as a nonprofit organization or hospital association. In the latter case, health departments are encouraged to work with their local hospital discharge data stewards to obtain the data. States may also contact the National Association of Health

Data Organizations (NAHDO) for assistance in working with these data and/or their local affiliate. Contact information for NAHDO and its affiliates is available on the Internet at: http://www.nahdo.org/memberlist.aspx.

2. Average number of asthma ED visits per day, by month

- Obtain the number of ED visits by using the guidelines in 1 above.
- Using a variable in your ED data file that documents the month of visit, produce a table that stratifies the number of ED visits by the month. If no month of visit variable is present, utilize the date of visit to derive the month.
- Divide each month's number of ED visits by the number of days in that month to get the Average number of ED visits per day, by month. This step corrects for different number of days per month. Round to the nearest whole number.

3. Minimum and Maximum Daily Visits

- Using the date of the visit variable in the hospital discharge file, generate visit frequencies for each day of the year.
- Select the smallest and largest numbers.

4. Annual crude rate of ED visits per 10,000 residents

To obtain the denominator for the rate:

- Go to the U.S. Census Population Estimates website: http://www.census.gov/popest/states/ If your state requires use of a specific census file, please use the data required by your state to obtain the denominator for inter-censal years.
- From the "Related Topics" heading, middle of the page, and on the right, select "*state estimates by demographic characteristics.*"
- From the left side of the page, under "Vintage 20XX", where '20XX' represents the most recent available year, select "*Median Age and Age by Sex.*"
- Print or alternatively download the table for your state by using one of the available file formats, such as Excel or CSV.
- Obtain the state population total from the table that includes "both sexes". The population estimate should correspond with the year for which you wish to calculate the ED visit rate.

To calculate annual ED visit rate per 10,000 residents:

- Divide the numerator, the number of visits obtained in 1 above, by the denominator, which represents the total state population obtained in 4 above.
- Multiply this result by 10,000. Round to two decimal points.
- This gives you the annual crude rate of asthma ED visits per 10,000 residents.

5. Annual age-adjusted rate of ED visits per 10,000 residents

To obtain the numerator for the rate:

- Obtain the number of ED visits by five-year age categories as documented in Table 1 below, by utilizing the criteria outlined in part 1 above ("Annual Number of ED Visits Due to Asthma"). Note that you will need to obtain the number of ED visits for 15-17 year olds and 18-19 year olds rather than "15-19" year olds.

- Enter the number of asthma ED visits by age category in Column B of Table 1. Column A is for Age Groups.

To obtain the denominator for the rate:

- Use previously obtained results from 4. For age groups 15-17 and 18-19:
    1. Population for 15-17:
        a) From the previously accessed US Census Table 2 for your state, obtain the number of persons under 18 years of age.
        b) Sum the totals for age categories representing "Under 5 years," "5-9 years," and "10-14 years." This gives you the number of persons under 15 years of age.
        c) Subtract 1b, persons <15 years, from 1a, persons <18 years. This gives you the population for 15-17 year olds.
    2. Population for 18-19:
        a) Subtract the number obtained in 1c (directly above) from the 15-19 year olds as provided in the US Census population estimate table. This will give you the population for 18-19 year olds.

To calculate the rate:

- Use Table 1 below; it is a pre-coded Excel spreadsheet which can be used for these calculations. The Age Groups are in column A.
- Columns B and C should already contain the values obtained in 4 above.
- Calculate the age-specific hospitalization rate by dividing the value in Column B by the value in Column C, and next placing this value in Column D. This computation will be done for you in the Excel spreadsheet.
- Column E is the weight of the US 2000 Standard population by age category. These values were derived from Table 1 in: http://www.cdc.gov/nchs/data/statnt/statnt20.pdf
- To calculate the annual age-adjusted rate of ED visits first multiply each row value in Column D by the same row value in Column E, and next place this product in Column F. Sum all row values in Column F, and multiply the total by 10,000. Round to two decimal places. This is value will be your annual age-adjusted ED visit rate per 10,000 residents.

Table 1: Image Representation of the Excel Calculation Table which Can Be Used to obtain the Annual State Age-adjusted Asthma ED Visit Rate/10,000 residents for Your State

	Column A	Column B	Column C	Column D	Column E	Column F
		State Resident ED Visits, for year "X"				
Row #	Age Group	# of ED Visits for Year "X"	State Pop for Year "X"	ED Visits / Pop	US 2000 Std Pop Weight	Adjusted ED Visit Rate
7	Under 5			B7/C7	0.069135	D7*E7
8	5-9			B8/C8	0.072532	D8*E8
9	10-14			B9/C9	0.073032	D9*E9
10	15-17			B10/C10	0.043035	D10*E10
11	18-19			B11/C11	0.029133	D11*E11
12	20-24			B12/C12	0.066478	D12*E12
13	25-29			B13/C13	0.06453	D13*E13
14	30-34			B14/C14	0.071044	D14*E14
15	35-39			B15/C15	0.080762	D15*E15
16	40-44			B16/C16	0.081851	D16*E16
17	45-49			B17/C17	0.072118	D17*E17
18	50-54			B18/C18	0.062716	D18*E18
19	55-59			B19/C19	0.048454	D19*E19
20	60-64			B20/C20	0.038793	D20*E20
21	65-69			B21/C21	0.034264	D21*E21
22	70-74			B22/C22	0.031773	D22*E22
23	75-79			B23/C23	0.027	D23*E23
24	80-84			B24/C24	0.017842	D24*E24
25	85+			B25/C25	0.015508	D25*E25
	Total					**[Σ(F7:F25)] *10,000**

*A pre-formatted Excel spreadsheet is available for your use. This spreadsheet will auto-calculate the age-adjusted ED visit rate. The user enters state population totals for each age category, followed by the number of state asthma ED visits. The computation is first done for each age category and then, at the bottom of the table, for the entire year.

TOPIC AREA: Respiratory Disease

INDICATOR: ASTHMA EMERGENCY DEPARTMENT VISITS

MEASURES	Annual number of emergency department visits with a primary diagnosis of asthma (ICD-9-CM 493.00—493.99) Average number of visits per day, by month Minimum and maximum daily numbers Annual crude rate of emergency department visits Annual age-adjusted rate of emergency department visits
POPULATION DENOMINATOR	Annual total population estimate for the calendar year, obtained from U.S. Bureau of the Census or other data sources.
DEMOGRAPHIC UNIT	Data obtained from hospital administrative data sets, U.S. Bureau of the Census, and other sources can also be used to examine measures by: 1) age categories such as 0-4, 5-14, 15-34, 35-64 and 65+; 2) sex; 3) race; 4) ethnicity; 5) measures of poverty; 6) out of state emergency department visits; 7) primary insurer/payer; 8) E-codes; 9) suspected causes, such as adverse drug reactions or exposure to outdoor or indoor air pollutants such as Environmental Tobacco Smoke (ETS); 10) CPT severity codes; 11) co-morbidities such as diagnosis of Chronic Obstructive Pulmonary Disease (COPD), pneumonia, bronchitis or influenza; and 12) V-codes.
GEOGRAPHIC UNIT	State, County, Zip Code
TEMPORAL UNIT	Calendar Year, Quarter/Season, Month, Day
SIGNIFICANCE AND BACKGROUND	As a chronic disease, asthma adversely impacts millions of Americans and consumes billions of dollars in health care costs. Available annual statistical estimates identified 22.2 million people who have current asthma in 2005[1]. Between 2001-2003 there were approximately 1.8 million annual asthma emergency department (ED) visits[2.] Severe outcomes for asthmatics included 497,000 hospitalizations in 2004 and 4,055 asthma deaths in 2003[1]. Between 1992 and 1999, the number of ED asthma visits increased 36%, and the asthma ED visit rate went up 29%[3]. Asthma prevalence has been consistently reported to be higher in children[4]. In addition to age, race, income and geography are reliable predictors of poor asthma outcomes[5]. African-American race, poverty, and lack of insurance, or reliance on public insurance, have been specifically linked to increased ED asthma visits, especially in children[6-10]. Based on a review of available scientific evidence, the Institute of Medicine concluded that allergens, which included specific sources such as cats, cockroaches and house dust mites, caused asthma exacerbations, as did Environmental Tobacco Smoke (ETS) in preschool-aged children[11]. In 2005 the California Air Resources Board also concluded that ETS caused asthma exacerbations in children and adults; their estimate was 202,300 excess annual childhood asthma episodes attributed to ETS[12]. There are also large direct ($14.7 billion) and indirect ($5.0 billion) annual health care and other costs associated with asthma[13]. Environment Attributable Fractions of 1988-1994 asthma costs were estimated at 39.2% for children <6 years and 44.4% for 6-16 year olds; the dollar total for each age group exceeded $400 million[14]. Associations between environmental exposures and asthma have been repeatedly demonstrated for measures of severity, hospitalizations as well as deaths. Many outdoor air pollutants have been associated with increased asthma ED visits. There is strong scientific evidence for direct associations between increased ozone concentrations and more asthma ED visits, especially in children, and also in adults[6, 15-17]. In one study, asthma ED visits increased by 33 percent when daily 1-hour maximum ozone concentrations exceeded 75 ppb[16]. Associations between asthma-related ED visits and ambient air particulate matter—both PM_{10} and $PM_{2.5}$—have been repeatedly confirmed, and are especially robust for children[15, 17-19]. Other pollutants related to higher asthma ED visit totals include carbon monoxide (CO), nitrogen dioxide (NO2), and pollution from coal and petrochemical sources[15, 18-21]. To again emphasize the obvious, children fare worse than adults. Other outdoor environmental triggers for asthma ED visits in children include weed and tree pollen, and ambient temperature[6]. Increased asthma ED visits have also been associated with ETS in other studies not reviewed previously[22-23]. There is a strong and reproducible temporal component to children's asthma ED visits.

	Asthma ED visits in children have been consistently higher in the fall, always co-occurring with the start of the school year; interestingly, increases in ED asthma visits in children have been shown to be related to increased respiratory viral infections[21, 24-25].
RATIONALE	Current scientific and clinical consensus is that the majority of acute asthma events, particularly emergency department visits, can be prevented if asthma is properly managed according to established medical guidelines, which specifically include reducing or avoiding exposure to environmental triggers[11, 26]. Asthma emergency department visits, a well documented health outcome measure, can be used to evaluate the contribution of environmental impacts, provided there are enough observations to permit the analysis of temporal and geographic trends. Also, health care provider-diagnosed asthma is not subject to recall bias, as is the case with national asthma estimates derived from the Centers for Disease Control and Prevention's Behavioral Risk Factor Surveillance System, which are used to generate a single estimate of current or lifetime prevalence. Asthma emergency department visits are contained in well maintained electronic data files which are readily available to qualified users through many state health departments. Even when personal identifiers are not available, emergency department data with day of service and residential location, such as county or zip code of residence, should be sufficient to confirm previously documented or new space-time trends[13, 27]. This type of descriptive spatial epidemiologic information may make it possible to document the contribution of environmental hazards on asthma ED visits. This type of indicator-based information may be useful in designing, implementing and evaluating new interventions which have the potential to lower the occurrence of ED asthma visits. Examples of these types of population-based interventions can include the increased use of air quality alerts or further enforcement of no-smoking policies.
LIMITATIONS OF THE MEASURE	This asthma ED visits measure only includes a single dimension of a much larger asthma burden on individuals and society. Under optimal circumstances, asthma ED visits should be evaluated in conjunction with multiple datasets: asthma mortality, hospitalizations, urgent care visits and computed asthma prevalence, an approach now articulated in several *MMWR* publications mentioned previously, i.e., Moorman and associates[2], and Mannino and colleagues[3]. We and others re-iterate that extreme care must be taken when comparisons are made between states when the purpose of the analysis is to attribute *environmental causes* to asthma ED visits, because myriad environmental factors have already been shown to affect asthma control and impact the use of the ED as the preferred source to medically manage asthma events. Some, but not all, of these factors can include regional medical treatment preferences related to the dispensing of prescribed medications, patient compliance with medical treatment requirements, health care availability, health care accessibility and co-morbidities. Additionally, results obtained by using this asthma ED indicator should be interpreted with caution when used to evaluate programs aimed at reducing asthma burden. Factors to consider should include the sensitivity of this measure to detect environmental changes, consistency in health care access, clinical practice guidelines, and availability and efficacy of dispensed medications. Finally, this measure only includes state residents who visited hospitals in their own state. State emergency department datasets may not include all facilities or populations. They may exclude Veterans Administration hospitals, Indian Health Service facilities, or institutionalized (prison) populations. Hospital access and admission/discharge patterns also differ among states. Inter-state differences in medical practice patterns and payment mechanisms may also affect diagnostic coding and health care provider decisions. Patients could be exposed to environmental triggers in multiple locations, but ED data only codes a single residential location at time of service. It is possible that residents of one state may visit the ED in a neighboring state; this outcome is not easily captured in the ED data for the state where the exposure occurred.
RECOMMENDATIONS/USES	This indicator can be used, under some circumstances, to evaluate the prevalence of asthma ED visits in different geographic areas and increases or decreases over time. Associations with environmental factors such as Ozone (O_3), Particulate Matter ($PM_{2.5}$ or PM_{10}), and ETS may be evaluated descriptively, if good quality data are available,

	and the findings are judiciously interpreted and used. Another reason for using this ED asthma indicator is to select areas with higher ED asthma prevalence to carry out and then empirically assess environmental public health intervention programs.
RELATED MEASURES	• *Healthy People 2010*, Chronic Disease Indicators • Centers for Disease Control and Prevention's Behavioral Risk Factor Surveillance System (asthma prevalence data, asthma history module, asthma call-back survey) • Environmental Protection Agency's air quality data for particulate matter and ozone
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