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**Introduction:**

Death due to asthma is a rare and preventable event; successful asthma management decreases the risk of asthma death. The following chapter provides an in depth review of asthma mortality in Michigan, highlighting the observed disparities and trends. Selected results from the Asthma Mortality Review Project are also included.

**Key Findings:**

- From 2004 through 2006, there were 393 asthma deaths in Michigan, for a rate of 12.6 deaths per 1,000,000 people.
- Rates of asthma mortality for white persons increased by age group. Rates of asthma mortality for black persons were not significantly different between age groups.
- Between 2000 and 2006, rates of asthma mortality for children 5 to 14 years were significantly increasing while rates for adults 65 years and older were significantly decreasing.
- Asthma deaths for residents of Wayne County (197 deaths) during 2002-2006 account for 30% of all deaths for Michigan residents. Michigan counties with rates of asthma death significantly higher than the Michigan rate were Iosco, Saginaw, and Wayne Counties.
- For asthma deaths investigated by the Asthma Mortality Review Project:
  - ⇒ 71% of children and over 40% of adults were enrolled in Medicaid at the time of their death.
  - ⇒ Only 33% of children and less than 10% of adults had an asthma action plan.

**Key Recommendations:**

- Michigan should develop projects aimed to implement recommendations made by the Asthma Mortality Review expert panels, including:
  - ⇒ Provider education on asthma risk and control, including the importance of the prescription of adequate levels of inhaled corticosteroid medication.
  - ⇒ Case management for high-risk patients.
  - ⇒ Pharmacy notification to health care providers for patients who repeatedly fill prescriptions for short-acting  $\beta$ -agonist medications.
  - ⇒ Referral to specialty care for patients with a hospitalization or emergency department visit or who use short-acting  $\beta$ -agonist medication daily.

**Key Recommendations, Continued:**

- Michigan should continue to investigate asthma deaths to identify causal factors, especially in geographic areas of high asthma mortality.

**The Asthma Initiative of Michigan (AIM)**

AIM is a collaborative effort involving multiple partners from public and private sectors across the state and is committed to reducing the burden of asthma documented in this report. For information about AIM's priorities and interventions, please review the strategic plan for the initiative: *Asthma in Michigan 2010: A Blueprint for Action*. (<http://www.getastmahelp.org/reports.asp>)

**Data Sources:**

Michigan Death Files

Population Estimates

Michigan Department of Community Health

Asthma Mortality Review Project

Michigan State University & Michigan

Department of Community Health

**Methods:**

1. General Asthma Mortality Surveillance: An asthma death is defined by the primary cause of death (ICD-10=J45 or J46). Age-adjusted asthma mortality rates are calculated for the three-year period 2004-2006, using the direct standardization method and the 2000 US standard population, and presented per 1,000,000 population. Rates are calculated by age, race, and sex to identify disparities and patterns. 95% confidence intervals accompany all mortality rates. Mortality rates for demographic units with a small number of events (less than 5) or a small population size (less than 5,000) are not calculated due to statistical instability. Additionally, counts less than 5 are not presented to protect the identity of those who have died. The data source for these analyses is the Michigan Death Files, which includes all deaths that occurred in Michigan and those for Michigan residents that occurred in other states during the study period. Analyses presented in this report are inclusive of nonresidents of Michigan who died in Michigan, unless otherwise noted.

2. Asthma Mortality Review Project: Additional data regarding asthma deaths are provided from the Michigan Asthma Mortality Review Project—a joint surveillance initiative between Michigan State University and the Michigan Department of Community Health since 2002. Deaths for Michigan residents are identified from Michigan's Vital Statistics reporting system where asthma is the primary cause of the death. (ICD-10=J45 or J46) For each death, the death certificate is obtained from the MDCH Division for Vital Records and Health Statistics and an investigation is conducted. Medical records, a next of kin interview, an autopsy report, and pharmacy claims reports are collected for each death and summarized into a 2-page blinded case summary.

### Methods, continued:

These are discussed by expert panels, one for adult deaths and one for child deaths, that convene about once or twice a year. The panels review case summaries, identify reasons for the asthma death, and make recommendations to avoid future deaths. The age groups under in-depth investigation varied over the years of study: 2-18 years (2002-2006), 19-34 years (2002-2005), and 45-54 years (2006). The asthma management characteristics for investigated child and adult deaths are presented in this report. For additional data from the Michigan Asthma Mortality Review Project, review the published annual reports available at: <http://oem.msu.edu/annualreports.asp>.

For a detailed description of the methodology, see the publication: Rosenman KD, Hanna EA, Lyon-Callo SK, and Wasilevich EA. Investigating Asthma Deaths Among Children and Young Adults: Michigan Asthma Mortality Review. Public Health Reports 2007; 122: 373-381.

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### Suggested Citation:

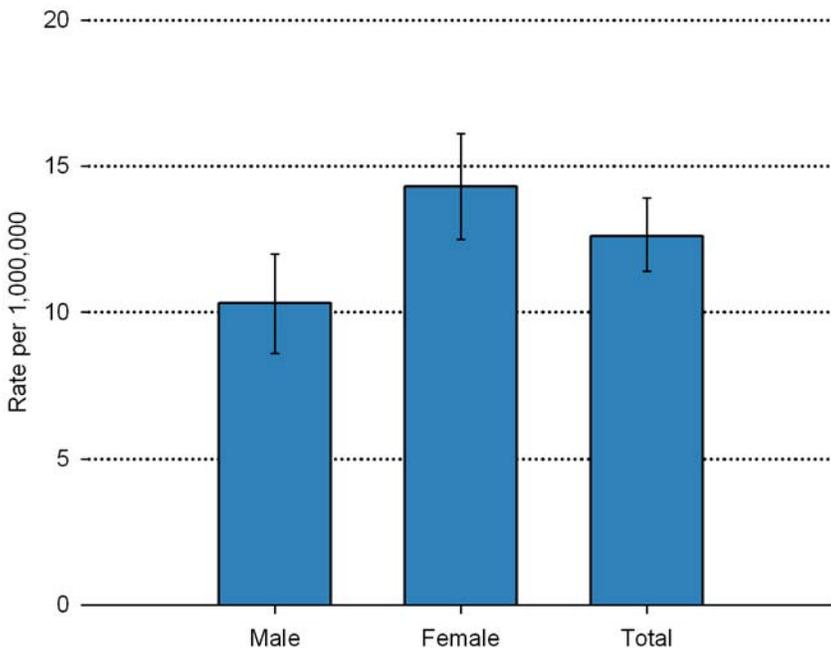
Wasilevich EA, Lyon-Callo S, Rosenman K, Hanna E, and Wasilevich MJ. "Asthma Mortality". Epidemiology of Asthma in Michigan. Bureau of Epidemiology, Michigan Department of Community Health, 2009.



For more information about the Asthma Initiative of Michigan, visit: [www.getastmahelp.org](http://www.getastmahelp.org) or call 1.866.EZLUNGS (1.866.395.8647).

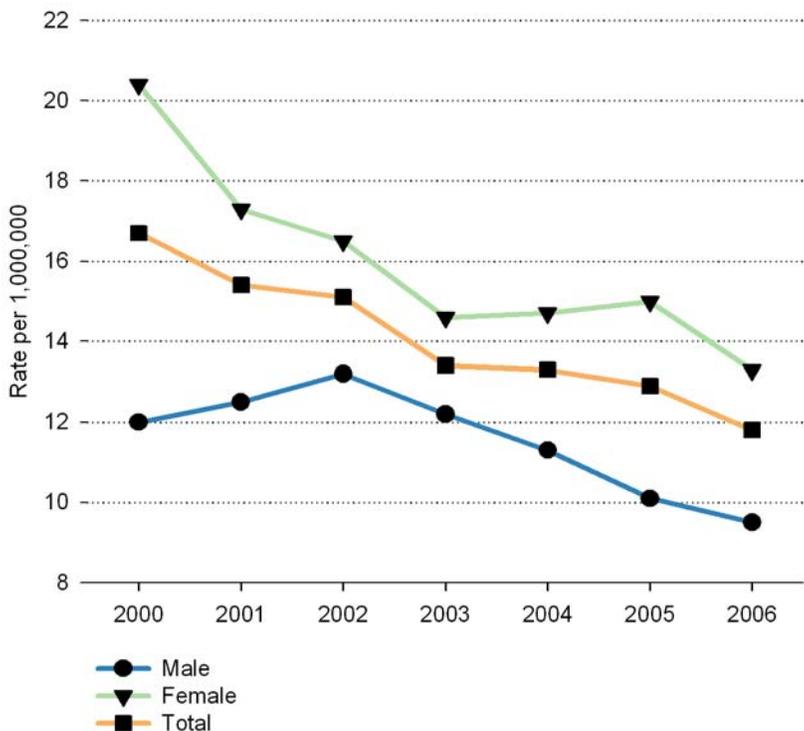
This surveillance publication was supported by Cooperative Agreement Number U59/CCU517742-07 from the Centers for Disease Control and Prevention (CDC). Its contents are solely the responsibility of the authors and do not necessarily represent the official views of the CDC.

1. Rate<sup>1</sup> of Asthma Mortality<sup>2</sup> Total and by Sex, Michigan, 2004-2006



- Between 2004 and 2006, there were 393 asthma deaths in Michigan, for a rate of 12.6 deaths per 1,000,000 people.
- The asthma mortality rate for females was not significantly different than that for males—14.3 per 1,000,000 versus 10.3 per 1,000,000, respectively.
- See figure 8 for comparison of mortality rates by sex and age.

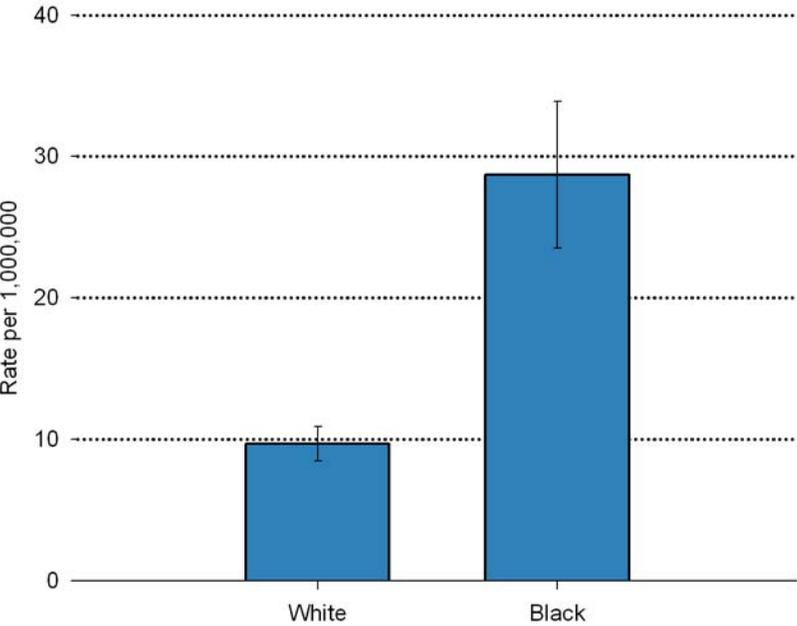
2. Annual Rate<sup>1</sup> of Asthma Mortality<sup>2</sup> Total and by Sex, Michigan,



- Between 2000 and 2006, the rates of asthma mortality for all persons in Michigan were significantly decreasing. ( $p < 0.05$ )<sup>3</sup>
- Comparing the 2000 and 2006 mortality rates for all persons, the percent decrease in the total rate was 29.3%.
- Mortality rates for females were significantly decreasing between 2000 and 2006. ( $p < 0.05$ )<sup>3</sup> The decreasing trend for mortality rates for males is nearly statistically significant. ( $p = 0.052$ )<sup>3</sup>
- Comparing the 2000 and 2006 mortality rates, the percent decrease in the rate for males was 20.8% and for females was 34.8%.

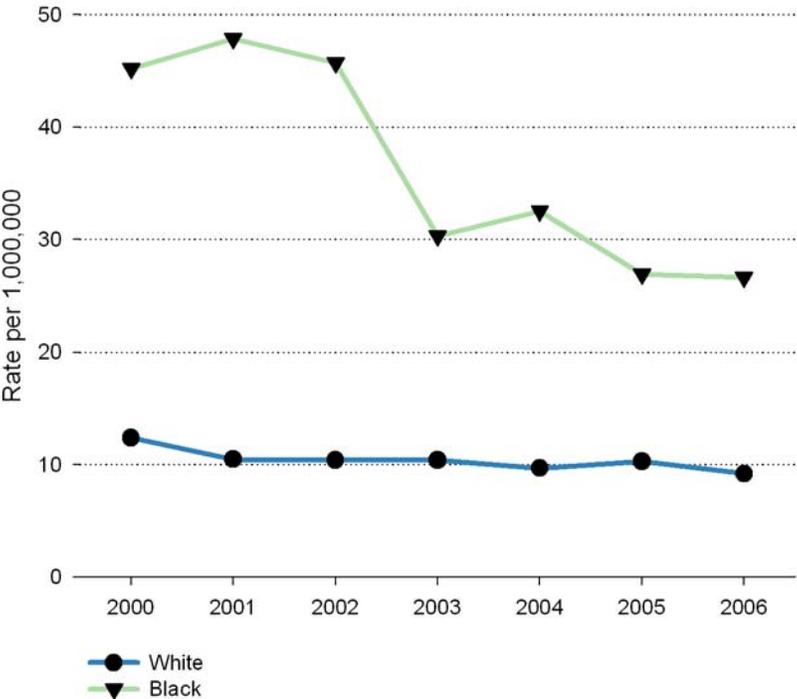
Data Notes:  
Sources:  
Michigan Death Files, MDCH.  
Population Data, MDCH: 2005 Michigan population for 3-year rates; corresponding annual Michigan population data for annual rates.  
1. Age-adjusted to the 2000 US Standard Population.  
2. Asthma as primary cause of death, ICD-10=J45 or J46.  
3. Spearman's correlation and rank correlation test.

3. Rate<sup>1</sup> of Asthma Mortality<sup>2</sup> by Race, Michigan, 2004-2006



- Between 2004 and 2006, there were 262 asthma deaths among white persons in Michigan, for a rate of 9.7 per 1,000,000.
- Between 2004 and 2006, there were 123 asthma deaths among black persons in Michigan, for a rate of 28.7 per 1,000,000.
- The asthma mortality rate for black persons was 3 times higher than that for white persons during this time period.

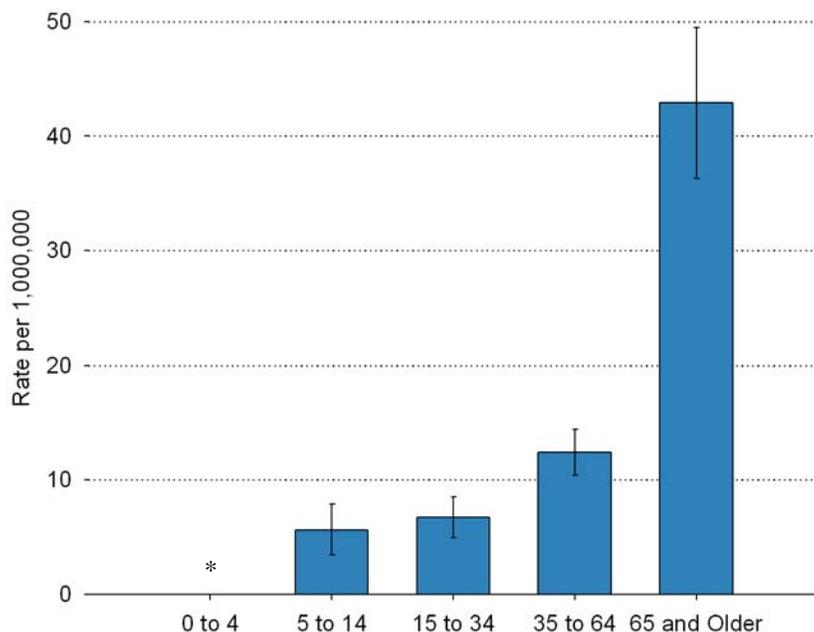
4. Annual Rate<sup>1</sup> of Asthma Mortality<sup>2</sup> by Race, Michigan, 2000-2006



- Mortality rates for both white and black persons were significantly decreasing between 2000 and 2006. ( $p < 0.05$  for each)<sup>3</sup>
- Comparing the 2000 and 2006 mortality rates, the percent decrease in the rate for black persons was greater than that for white persons, 41.2% versus 25.8%, respectively.

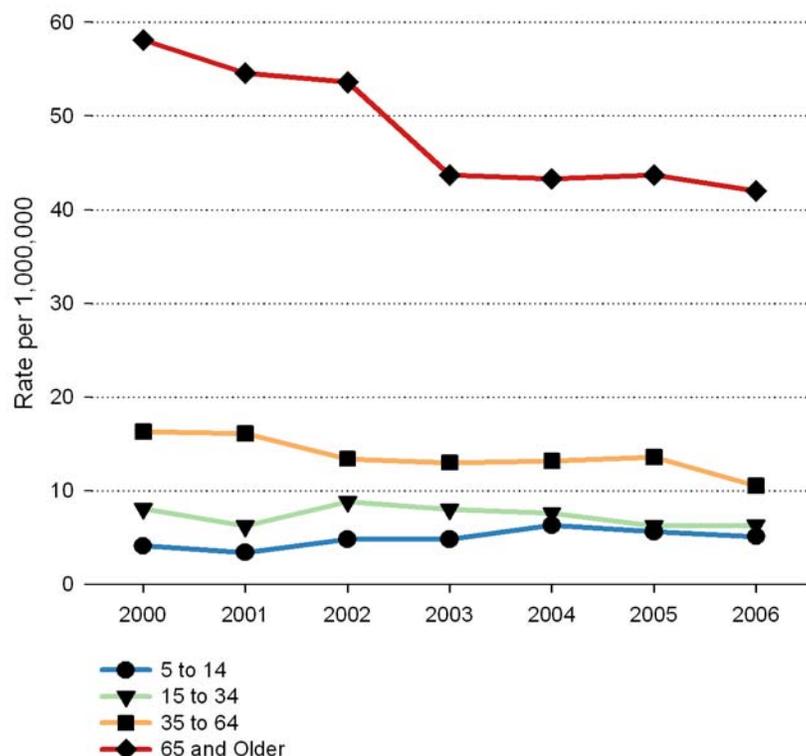
Data Notes:  
Sources:  
Michigan Death Files, MDCH.  
Population Data, MDCH: 2005 Michigan population for 3-year rates; corresponding annual Michigan population data for annual rates.  
1. Age-adjusted to the 2000 US Standard Population.  
2. Asthma as primary cause of death, ICD-10=J45 or J46.  
3. Spearman's correlation and rank correlation test.

5. Rate of Asthma Mortality<sup>1</sup> by Age Group, Michigan, 2004-2006



- Asthma mortality rates increased with age group; the highest asthma mortality rate was for adults age 65 years and older. (42.9 per 1,000,000)
- Rates of asthma mortality for individuals 5 to 14 years (5.6 per 1,000,000), 15 to 34 years (6.7 per 1,000,000), and 35 to 64 years (12.4 per 1,000,000) were significantly higher than the *Healthy People 2010*<sup>2</sup> target rates for these age groups—0.9 per 1,000,000, 1.9 per 1,000,000, and 8.0 per 1,000,000, respectively.
- The rate of asthma mortality for adults age 65 years and older (42.9 per 1,000,000) was not significantly different than the *Healthy People 2010*<sup>2</sup> target rate for this age group, 47.0 per 1,000,000.

6. Annual Rate of Asthma Mortality<sup>1</sup> by Age Group, Michigan, 2000-2006



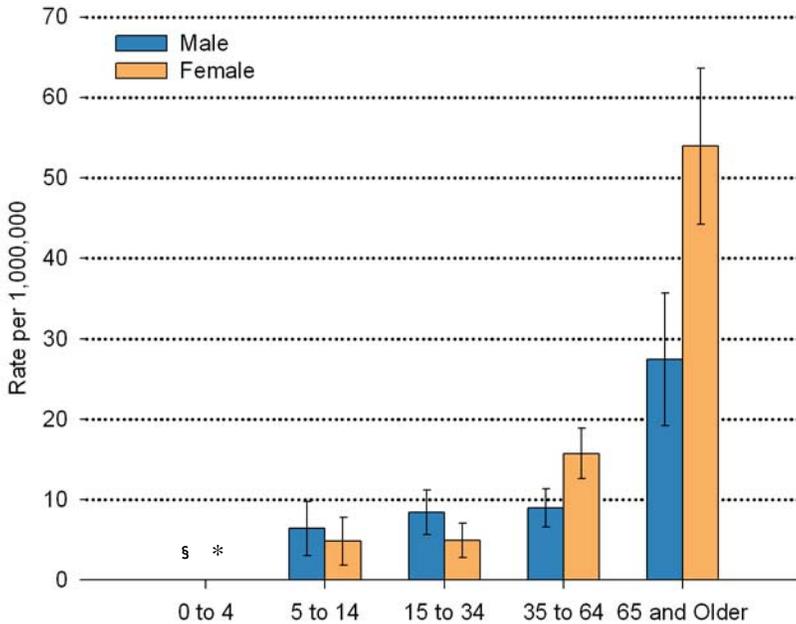
- Between 2000 and 2006, rates of asthma mortality for children 5 to 14 years were significantly increasing. ( $p < 0.05$ )<sup>3</sup> Comparing the 2000 and 2006 mortality rates, there was a 24.4% increase.
- Mortality rates for adults 65 years and older were significantly decreasing between 2000 and 2006. ( $p < 0.05$ )<sup>3</sup> Comparing the 2000 and 2006 mortality rates, there was a 27.7% decrease.
- The decreasing trend for mortality rates for adults age 35 to 64 years is nearly statistically significant. ( $p = 0.052$ )<sup>3</sup> Comparing the 2000 and 2006 mortality rates, there was a 35.6% decrease.
- Between 2000 and 2006, rates of asthma mortality for those aged 15 to 34 years were not significantly increasing or decreasing. ( $p > 0.05$ )<sup>3</sup>

Data Notes:  
Sources:  
Michigan Death Files, MDCH.  
Population Data, MDCH: 2005 Michigan population for 3-year rates; corresponding annual Michigan population data for annual rates.

1. Asthma as primary cause of death, ICD-10=J45 or J46.
2. Sponsored by the US Department of Health and Human Services, the *Healthy People 2010* initiative is a comprehensive set of disease prevention and health promotion objectives for the nation by the year 2010. For more information, visit: <http://www.healthypeople.gov/>.
3. Spearman's correlation and rank correlation test.

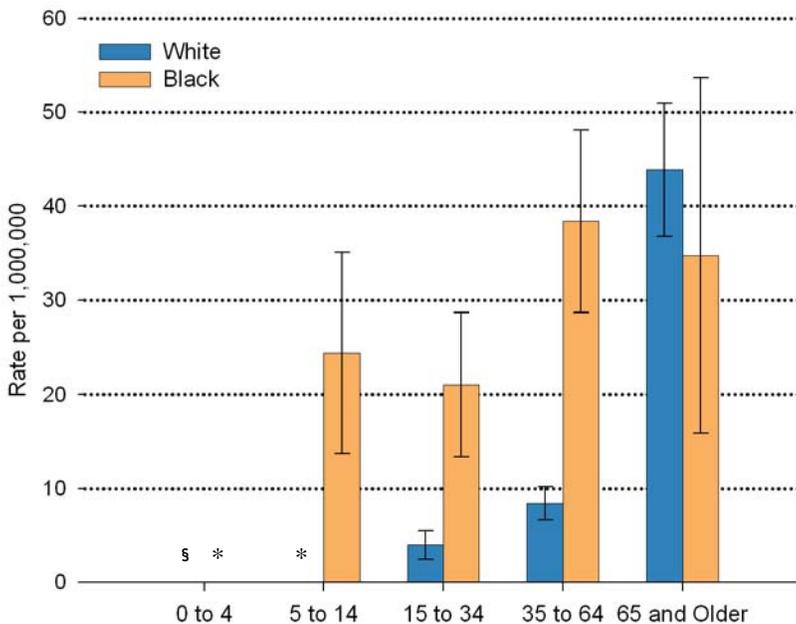
\*Number of events >0 but <5.

7. Rate of Asthma Mortality<sup>1</sup> by Sex and Age Group, Michigan, 2004-2006



- In older age groups, asthma mortality rates were significantly higher for females compared to males.
- Females age 65 years and older experienced the highest asthma mortality rate, 53.9 per 1,000,000.

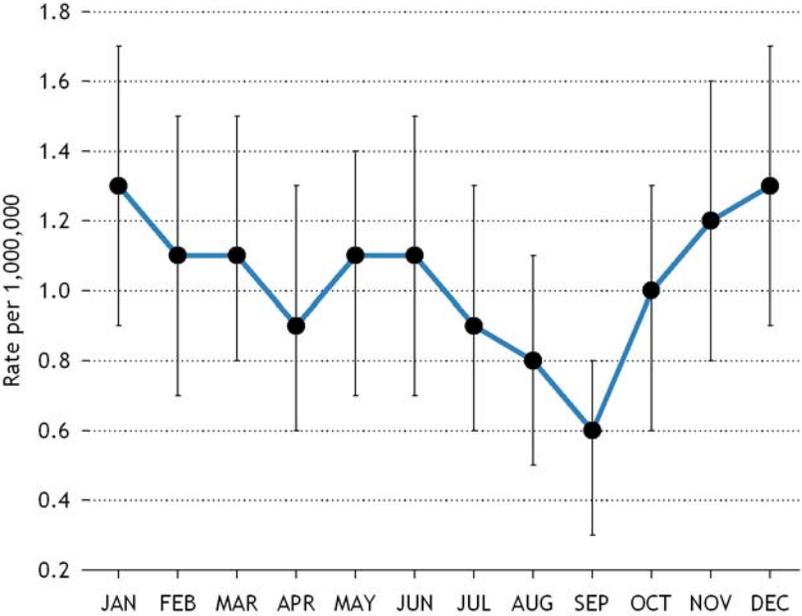
8. Annual Rate of Asthma Mortality<sup>1</sup> by Race and Age Group, Michigan, 2004-2006



- For ages groups 15 to 34 and 35 to 64 years, asthma mortality for black persons was significantly higher than for white persons.
- Rates of asthma mortality for white persons increased by age group. Rates of asthma mortality for black persons were not significantly different between age groups.
- Between 2004 and 2006, the case fatality rate was 72% higher for black adults (≥18 years) versus white adults (≥18 years), 278.9 per 1,000,000 and 162.6 per 1,000,000, respectively. (Data not shown.)<sup>2</sup>

Data Notes:  
Sources:  
Michigan Death Files, MDCH.  
2005 Population Data, MDCH.  
1. Asthma as primary cause of death, ICD-10=J45 or J46.  
2. Case fatality rate is calculated by dividing the number of deaths during the study period by the population with current asthma. For this calculation, estimates of the number of people with current asthma by race is provided by Behavioral Risk Factor Surveillance Survey (2005), MDCH.  
§ Number of events = 0.  
\*Number of events >0 but <5.

9. Rate<sup>1</sup> of Asthma Mortality<sup>2</sup> by Month of Death, Michigan, 2004-2006

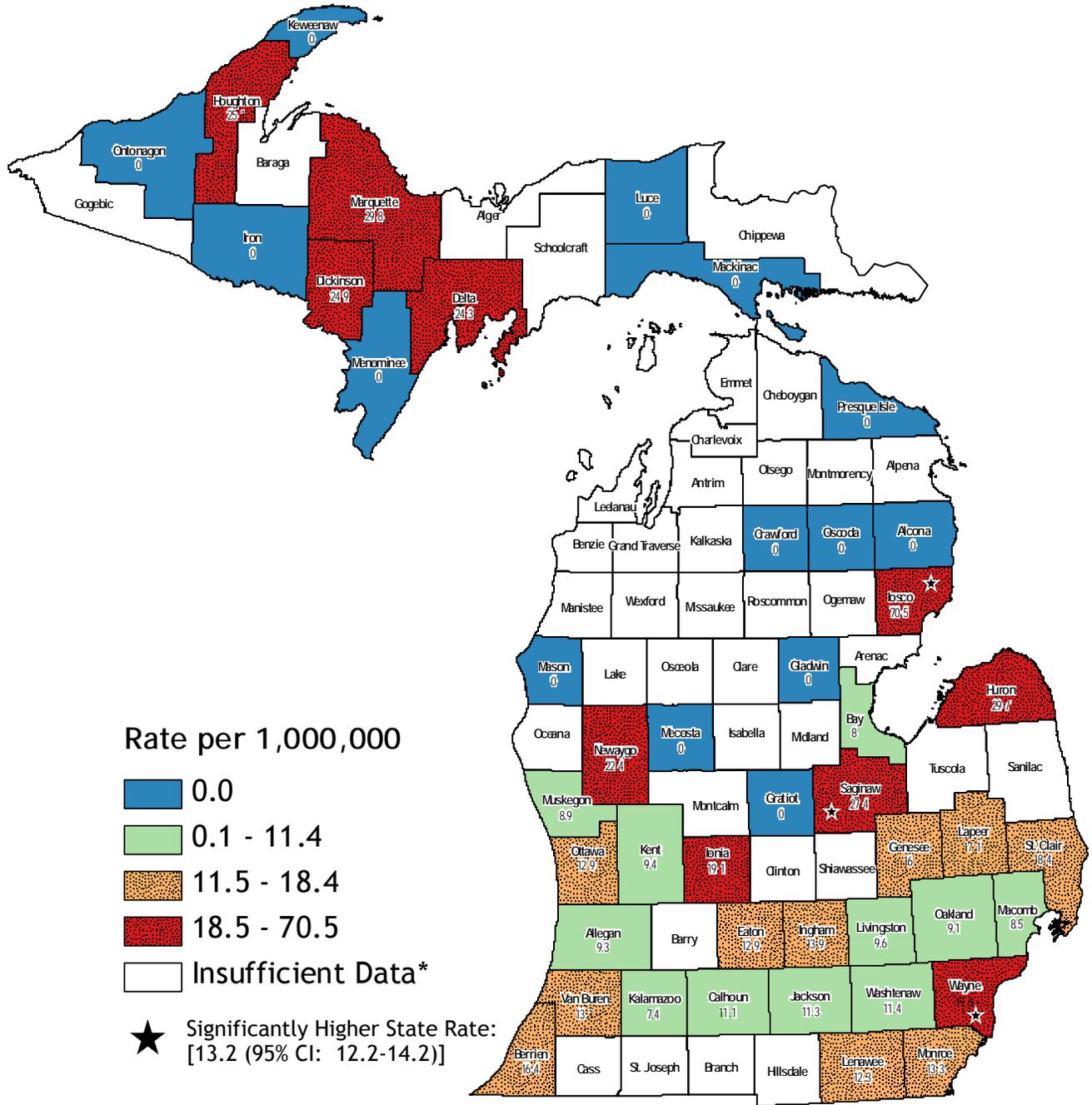


- The highest rate of asthma death occurred during December. The lowest rate of asthma death occurred in September.

Data Notes:  
Sources:  
Michigan Death Files, MDCH.  
2005 Population Data, MDCH.  
1. Age-adjusted to the 2000 US Standard Population.  
2. Asthma as primary cause of death, ICD-10=J45 or J46.



11. Rate<sup>1</sup> of Asthma Death<sup>2</sup> by County of Residence, Michigan, 2002-2006



- Michigan counties with rates of asthma death significantly higher than the state rate during 2002-2006 were Losco, Saginaw, and Wayne Counties.

Data Notes:  
Sources:  
Michigan Death Files, MDCH.  
2005 Population Data, MDCH.  
1. Age-adjusted to the 2000 US Standard Population.  
2. Asthma as primary cause of death, ICD-10=J45 or J46.  
\*Insufficient Data: Number of events >0 and <5.

12. Selected Characteristics for Child Asthma Deaths<sup>1</sup>, Age 2-18 Years, Michigan, 2002-2006

	Children, 2-18 Years (60 Deaths) <sup>1</sup> 2002-2006
<b>Insurance Status</b>	
Had Some Form of Health Insurance	96%
Enrolled in Medicaid at the Time of Death	71%
<b>Exposure to Triggers</b>	
Current Smoker	12%
Smoker in the Home	46%
Pets in the Home	47%
<b>Routine Asthma Management<sup>2</sup></b>	
Taking Only Inhaled Corticosteroids	40%
Taking Only Oral Corticosteroids	8%
Taking No Corticosteroids	29%
<b>Ever Seen by a Specialist</b>	<b>73%</b>
Ever Had Pulmonary Function Testing	55%
Regularly Used a Peak Flow Meter	62%
Had an Asthma Action Plan	33%
<b>Asthma Hospitalization</b>	
Ever in Lifetime	84%
In the Year Prior to Death	52%
<b>Asthma Emergency Department Visits</b>	
Ever in Lifetime	86%
In the Year Prior to Death	68%
Average Number in the Year Prior to Death	3

Data Notes:

Source: Asthma Mortality Review Project, MSU & MDCH.

1. All investigated deaths, asthma was primary cause of death, ICD-10=J45 or J46.
2. Indicators presented refer to corticosteroid medications only. Decedents may have been routinely taking short-acting  $\beta$ -agonist medications for quick relief of asthma symptoms.

13. Selected Characteristics for Adult Asthma Deaths<sup>1</sup>, Age 19-34 Years (2002-2005) and 45-54 Years (2006), Michigan

	Adults, 19-34 Years (65 Deaths) <sup>1</sup> 2002-2005	Adults, 45-54 Years (14 Deaths) <sup>1</sup> 2006
<b>Insurance Status</b>		
Had Some Form of Health Insurance	79%	100%
Enrolled in Medicaid at the Time of Death	41%	50%
<b>Exposure to Triggers</b>		
Current Smoker	43%	69%
Smoker in the Home	57%	64%
Pets in the Home	60%	67%
<b>Routine Asthma Management<sup>2</sup></b>		
Taking Only Inhaled Corticosteroids	35%	38%
Taking Only Oral Corticosteroids	14%	23%
Taking No Corticosteroids	37%	15%
<b>Ever Seen by a Specialist</b>		
Ever Had Pulmonary Function Testing	52%	56%
Regularly Used a Peak Flow Meter	56%	33%
Had an Asthma Action Plan	9%	0%
<b>Asthma Hospitalization</b>		
Ever in Lifetime	64%	73%
In the Year Prior to Death	45%	45%
<b>Asthma Emergency Department Visits</b>		
Ever in Lifetime	88%	91%
In the Year Prior to Death	68%	73%
Average Number in the Year Prior to Death	7.3	3.3

Data Notes:

Source: Asthma Mortality Review Project, MSU & MDCH.

1. All investigated deaths, asthma was primary cause of death, ICD-10=J45 or J46.
2. Indicators presented refer to corticosteroid medications only. Decedents may have been routinely taking short-acting  $\beta$ -agonist medications for quick relief of asthma symptoms.

**Rate of Asthma Mortality<sup>1</sup> (per 1,000,000), Michigan, 2004-2006**

			Count	Rate
Total <sup>2</sup> [Figure 1]			393	12.6 (11.4-13.9)
Sex <sup>2</sup> [Figure 1]	Male		146	10.3 (8.6-12.0)
	Female		247	14.3 (12.5-16.1)
Race <sup>2</sup> [Figure 3]	White		262	9.7 (8.5-10.9)
	Black		123	28.7 (23.5-33.9)
Age [Figure 5]	0-4 Years		§	*
	5-14 Years		24	5.6 (3.4-7.9)
	15-34 Years		55	6.7 (4.9-8.5)
	35-64 Years		151	12.4 (10.4-14.4)
	≥65 Years		162	42.9 (36.3-49.5)
Age & Sex [Figure 7]	0-4 Years	Male	0	0.0
		Female	§	*
	5-14 Years	Male	14	6.4 (3.1-9.8)
		Female	10	4.8 (1.8-7.8)
	15-34 Years	Male	35	8.4 (5.6-11.2)
		Female	20	4.9 (2.8-7.1)
	35-64 Years	Male	54	9.0 (6.6-11.4)
		Female	97	15.8 (12.6-18.9)
	≥65 Years	Male	43	27.4 (19.2-35.6)
		Female	119	53.9 (44.2-63.6)
Age & Race [Figure 8]	0-4 Years	White	0	0.0
		Black	§	*
	5-14 Years	White	§	*
		Black	20	24.4 (13.7-35.1)
	15-34 Years	White	26	4.0 (2.5-5.5)
		Black	29	21.0 (13.4-28.7)
	35-64 Years	White	86	8.4 (6.6-10.2)
		Black	60	38.4 (28.7-48.1)
	≥65 Years	White	147	43.9 (36.8-51.0)
		Black	13	34.7 (15.9-53.6)

Sources:

Michigan Death Files, MDCH.  
2005 Population Data, MDCH.

1. Asthma as primary cause of death, ICD-10=J45 or J46.

2. Age-adjusted to the 2000 US Standard Population.

§Number of events >0 but <5.

\*Number of events <5 or population <5,000.

**Annual Number of Asthma Deaths<sup>1</sup>, Michigan, 2000-2006**

	2000	2001	2002	2003	2004	2005	2006
Total	164	153	152	136	137	135	121
Sex							
Male	53	56	60	55	54	47	45
Female	111	97	92	81	83	88	76
Race							
White	105	91	91	91	86	94	82
Black	56	60	60	43	48	38	37
Age							
0-4 Years	§	§	§	§	0	0	§
5-14 Years	‡	‡	‡	‡	9	8	‡
15-34 Years	22	17	24	22	21	17	17
35-64 Years	63	63	53	52	53	55	43
≥65 Years	71	67	66	54	54	55	53

**Annual Rate<sup>2</sup> of Asthma Mortality<sup>1</sup> (per 1,000,000), Michigan, 2000-2006**

	2000	2001	2002	2003	2004	2005	2006
Total <sup>2</sup> [Figure 2]	16.7 (14.1-19.2)	15.4 (12.9-17.8)	15.1 (12.7-17.5)	13.4 (11.2-15.7)	13.3 (11.1-15.6)	12.9 (10.7-15.1)	11.8 (9.7-13.9)
Sex <sup>2</sup> [Figure 2]							
Male	12.0 (8.7-15.3)	12.5 (9.2-15.8)	13.2 (9.8-16.6)	12.2 (8.9-15.5)	11.3 (8.2-14.3)	10.1 (7.2-13.1)	9.5 (6.7-12.2)
Female	20.4 (16.6-24.2)	17.3 (13.8-20.7)	16.5 (13.1-19.9)	14.6 (11.4-17.8)	14.7 (11.5-17.9)	15.0 (11.8-18.2)	13.3 (10.3-16.4)
Race <sup>2</sup> [Figure 4]							
White	12.4 (10.0-14.7)	10.5 (8.4-12.7)	10.4 (8.3-12.6)	10.4 (8.3-12.6)	9.7 (7.6-11.7)	10.3 (8.2-12.4)	9.2 (7.2-11.2)
Black	45.2 (33.0-57.4)	47.9 (35.5-60.3)	45.7 (33.8-57.5)	30.3 (21.0-39.5)	32.5 (23.2-41.9)	26.9 (18.2-35.7)	26.6 (17.8-35.4)
Age [Figure 6]							
0-4 Years	*	*	*	*	0.0	0.0	*
5-14 Years	4.1 (0.8-7.3)	3.4 (0.4-6.4)	4.8 (1.2-8.3)	4.8 (1.3-8.4)	6.3 (2.2-10.3)	5.6 (1.7-9.6)	5.1 (1.3-8.8)
15-34 Years	8.1 (4.7-11.4)	6.2 (3.3-9.2)	8.8 (5.3-12.3)	8.0 (4.7-11.4)	7.6 (4.4-10.9)	6.2 (3.3-9.2)	6.3 (3.3-9.2)
35-64 Years	16.3 (12.3-20.4)	16.1 (12.1-20.1)	13.4 (9.8-17.0)	13.0 (9.5-16.5)	13.2 (9.6-16.7)	13.6 (10.0-17.1)	10.5 (7.4-13.6)
≥65 Years	58.1 (44.6-71.7)	54.6 (41.5-67.7)	53.6 (40.6-66.5)	43.7 (32.0-55.3)	43.3 (31.8-54.9)	43.7 (32.2-55.3)	42.0 (30.7-53.4)

**Rate<sup>2</sup> of Asthma Mortality<sup>1</sup> (per 1,000,000) by Month of Death, Michigan, 2004-2006**

	Count	Rate [Figure 9]
January	42	1.3 (0.9-1.7)
February	35	1.1 (0.7-1.5)
March	35	1.1 (0.8-1.5)
April	29	0.9 (0.6-1.3)
May	33	1.1 (0.7-1.4)
June	33	1.1 (0.7-1.5)
July	29	0.9 (0.6-1.3)
August	25	0.8 (0.5-1.1)
September	18	0.6 (0.3-0.8)
October	30	1.0 (0.6-1.3)
November	36	1.2 (0.8-1.6)
December	40	1.3 (0.9-1.7)

Sources:

Michigan Death Files, MDCH.  
Population Data, MDCH: 2005 Michigan population for 3-year rates; corresponding annual Michigan population data for annual rates.

1. Asthma as primary cause of death, ICD-10=J45 or J46.

2. Age-adjusted to the 2000 US Standard Population.

§Number of events >0 but <5.

‡Data suppressed due to a low number of events in the 0 to 4 year age group.

\*Number of events >0 and <5 or population <5,000.

**Number and Rate<sup>1</sup> (per 1,000,000) of Asthma Mortality<sup>2</sup> by County of Residence, Michigan, 2002-2006**

County	Total [Figures 10 & 11]	
	Count	Rate
Alcona	0	0.0
Alger	\$	*
Allegan	5	9.3 (1.1 -17.5)
Alpena	\$	*
Antrim	\$	*
Arenac	\$	*
Baraga	\$	*
Barry	\$	*
Bay	5	8 (0.7 -15.2)
Benzie	\$	*
Berrien	14	16.4 (7.7 -25.1)
Branch	\$	*
Calhoun	8	11.1 (3.4 -18.8)
Cass	\$	*
Charlevoix	\$	*
Cheboygan	\$	*
Chippewa	\$	*
Clare	\$	*
Clinton	\$	*
Crawford	0	0.0
Delta	7	24.3 (6.2 -42.5)
Dickinson	6	24.9 (4.3 -45.5)
Eaton	7	12.9 (3.3 -22.5)
Emmet	\$	*
Genesee	35	16 (10.7 -21.4)
Gladwin	0	0.0
Gogebic	\$	*
Grand Traverse	\$	*
Gratiot	0	0.0
Hillsdale	\$	*
Houghton	5	25.1 (2.9 -47.3)
Huron	5	29.7 (1.3 -58.1)
Ingham	19	13.9 (7.6 -20.3)
Ionia	5	19.1 (2.3 -35.9)
Iosco	11	70.5 (23.6 -117.4)
Iron	0	0.0
Isabella	\$	*
Jackson	10	11.3 (4.3 -18.4)
Kalamazoo	8	7.4 (2.2 -12.6)
Kalkaska	\$	*
Kent	26	9.4 (5.8 -13.1)
Keweenaw	0	0.0

County	Total [Figures 10 & 11]	
	Count	Rate
Lake	\$	*
Lapeer	7	17.1 (4.2 -30.0)
Leelanau	\$	*
Lenawee	6	12.3 (2.4 -22.2)
Livingston	7	9.6 (2.2 -17.0)
Luce	0	0.0
Mackinac	0	0.0
Macomb	37	8.5 (5.7 -11.2)
Manistee	\$	*
Marquette	11	29.8 (12.1 -47.5)
Mason	0	0.0
Mecosta	0	0.0
Menominee	0	0.0
Midland	\$	*
Missaukee	\$	*
Monroe	10	13.3 (5.0 -21.7)
Montcalm	\$	*
Montmorency	\$	*
Muskegon	8	8.9 (2.7 -15.1)
Newaygo	6	22.4 (4.4 -40.3)
Oakland	56	9.1 (6.7 -11.5)
Oceana	\$	*
Ogemaw	\$	*
Ontonagon	0	0.0
Osceola	\$	*
Oscoda	0	0.0
Otsego	\$	*
Ottawa	15	12.9 (6.3 -19.5)
Presque Isle	0	0.0
Roscommon	\$	*
Saginaw	30	27.4 (17.5 -37.3)
St. Clair	17	18.4 (9.6 -27.3)
St. Joseph	\$	*
Sanilac	\$	*
Schoolcraft	\$	*
Shiawassee	\$	*
Tuscola	\$	*
Van Buren	5	13.1 (1.6 -24.7)
Washtenaw	16	11.4 (5.7 -17.1)
Wayne	197	19.6 (16.9 -22.4)
Wexford	\$	*
All Counties <sup>3</sup>	676	13.1 (12.1 -14.1)

Sources:  
Michigan Death Files, MDCH.  
2004 Population Data, MDCH.  
1. Age-adjusted to the 2000 US Standard Population.  
2. Asthma as primary cause of death, ICD-10=J45 or J46.  
3. Excludes nonresidents of Michigan.  
<sup>§</sup>Number of events >0 but <5.  
<sup>\*</sup>Number of events >0 and <5 or population <5,000.