

Epidemiology of Asthma

In the Mid-Michigan Counties of

Clinton, Eaton, and Ingham

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Section 1: Asthma Prevalence

Prevalence is the proportion of individuals in a population who have the disease at a point in time or during a given time period. It is often used to describe the health burden on a given population. Using prevalence estimates of current asthma from the Michigan Behavioral Risk Factor Survey (BRFS), estimates of the number with asthma living in each county are given in this section.

Current asthma prevalence is the proportion of survey respondents who reported that in their lifetime a health care professional told them they have asthma and reported “yes” to the question: Do you still have asthma?

The Michigan BRFS is the source of most estimates of the prevalence of certain health behaviors, conditions, and practices associated with leading causes of death. Data are collected quarterly by telephone interview; a sample of telephone numbers is selected using a list-assisted, random-digit dialed methodology.

From this survey, the prevalence of asthma can be determined for adults (≥ 18 years) and children (< 18 years). Data for children are based on information provided by an adult respondent about children living in their home. Due to small sample size, descriptive information regarding children is limited, precluding prevalence analysis by age, race, and sex strata.

Data from the BRFS are designed to estimate prevalence statewide. However, using asthma prevalence for the State of Michigan, we can approximate the number of individuals with asthma in specific counties and local coalitions. In this report, the number of adults (≥ 18 years) with asthma was calculated using the asthma prevalence rates from the 2003 Michigan Behavioral Risk Factor Survey. The number of children with asthma was calculated from the prevalence rates reported in the 2002 Michigan Behavioral Risk Factor Survey.

Number of Children (aged less than 18 years) [1] and Adults (aged 18 years and older) [2] with Asthma in Mid-Michigan [3] and the State of Michigan.

	Children (<18 Years)	Adults (≥18 Years)
	2002	2003
Clinton	1,607	4,673
Eaton	2,404	7,470
Ingham	5,976	20,186
Mid-Michigan	9,987	32,329
Michigan	233,894	701,319

1 Number of children with current asthma was calculated by multiplying the population of children in 2002 by the percentage of adults reporting current asthma for children in the home in the 2002 Michigan BRFs.

2 Number of adults with current asthma was calculated by multiplying the population of adults in 2003 by the percentage reporting current asthma in the 2003 Michigan BRFs.

3 Mid-Michigan is defined by the Mid-Michigan Asthma Coalition coverage area (Clinton, Eaton, Ingham Counties).

Data Source: Behavioral Risk Factor Survey, Michigan, 2002 and 2003

Section 2: Hospitalization for Asthma

Preventable hospitalizations are those where timely and effective ambulatory care can prevent the onset of an illness or condition, control an acute episode of an illness, or manage a chronic disease or condition so that hospitalization is unnecessary. Asthma hospitalizations are considered preventable because patients with asthma should be able to stay out of the hospital if they have and use good asthma management techniques.

Hospitalization data was acquired from the Michigan Inpatient Database for the years 1990 to 2002. All hospital discharges from any of Michigan's reporting acute care hospitals or Michigan residents discharged from reporting acute care hospitals in contiguous states are included in this database. It includes virtually all hospitalizations in Michigan and for Michigan residents during this time period.

There is no confirmed case classification for an asthma hospitalization. In accordance with the case definition for a probable asthma hospitalization recommended by the Council for State and Territorial Epidemiologists (CSTE), all inpatient hospitalizations are selected from the database where asthma was the primary reason for the stay. (Position Statement 1998-EH/CD1) These are hospitalizations with primary discharge diagnosis coded to the International Classification of Disease (ICD) Version-9-CM codes 493.XX.

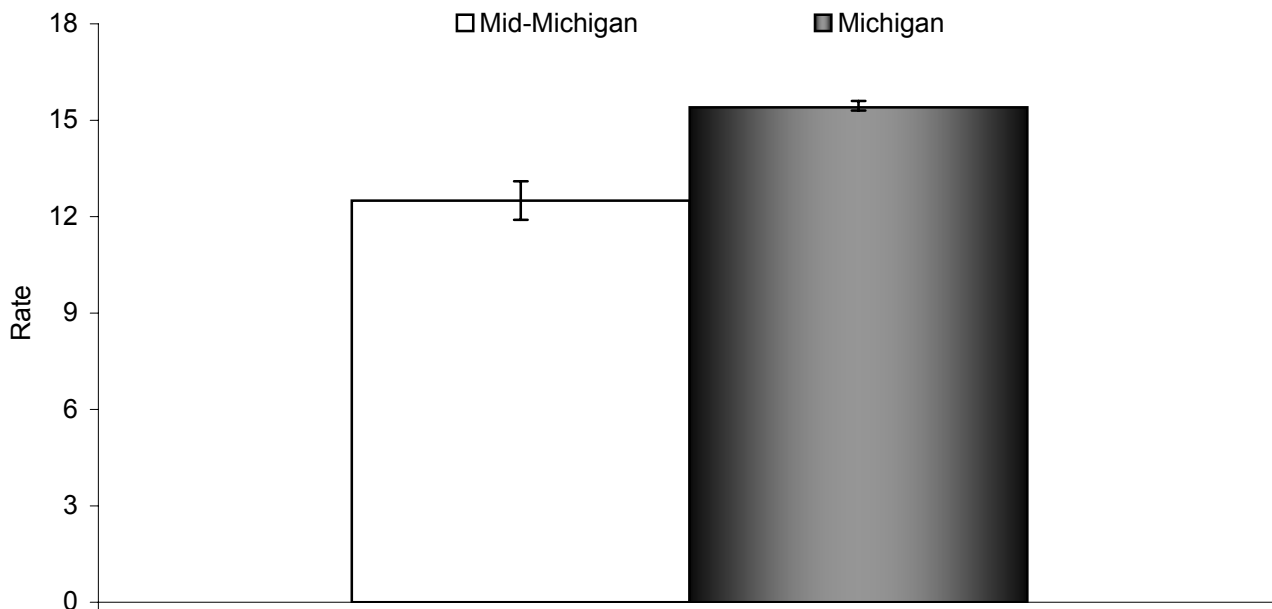
These data are the number of inpatient hospitalizations for asthma. This is not the same as the number of individual people hospitalized for asthma. An individual can be hospitalized more than once for the same condition during the study period and multiple hospitalizations cannot be distinguished from this data source. From these data, age-adjusted asthma hospitalization rates are calculated and presented per 10,000 population. Rates are age adjusted so that valid comparisons can be made between populations of different age distributions.

Hospitalization rates for demographic or geographic units with a small number of events (less than or equal to 20 events) or a small population size (less than 5,000 population) are not calculated because these rates are statistically unstable. In addition, to protect the identity of persons who have been hospitalized, counts less than 5 are not presented in this report.

Ninety five percent confidence intervals are computed for hospitalization rates where more than one year of data are combined. The confidence interval estimates the statistical uncertainty of the asthma hospitalization rate and can be used to test whether a specific measure is statistically different between groups. Average asthma hospitalization rates are considered statistically different between groups if their 95% confidence intervals do not overlap. This technique is used to compare rates for demographic subpopulations, such as male versus female, and geographical subpopulations, such as county versus state.

To determine if annual asthma hospitalization rates follow an increasing or decreasing trend over the 13-year period 1990-2002, the Spearman Correlation Coefficient and its accompanying statistical Rank Correlation Test are utilized. This test assesses whether there is a statistically significant monotonic relationship between 2 variables, in this case year and asthma hospitalization rate, without making any assumption about the underlying distribution of the data. This statistical test does not determine the significance of more complex trend patterns. There is no way to know from these statistics if a specific event or series of events caused a change in asthma hospitalization rates.

Figure 1. Rates (per 10,000) [1,2] of Hospitalization due to Asthma [3] for Mid-Michigan [4] and the State of Michigan, All Ages, 2000-2002.



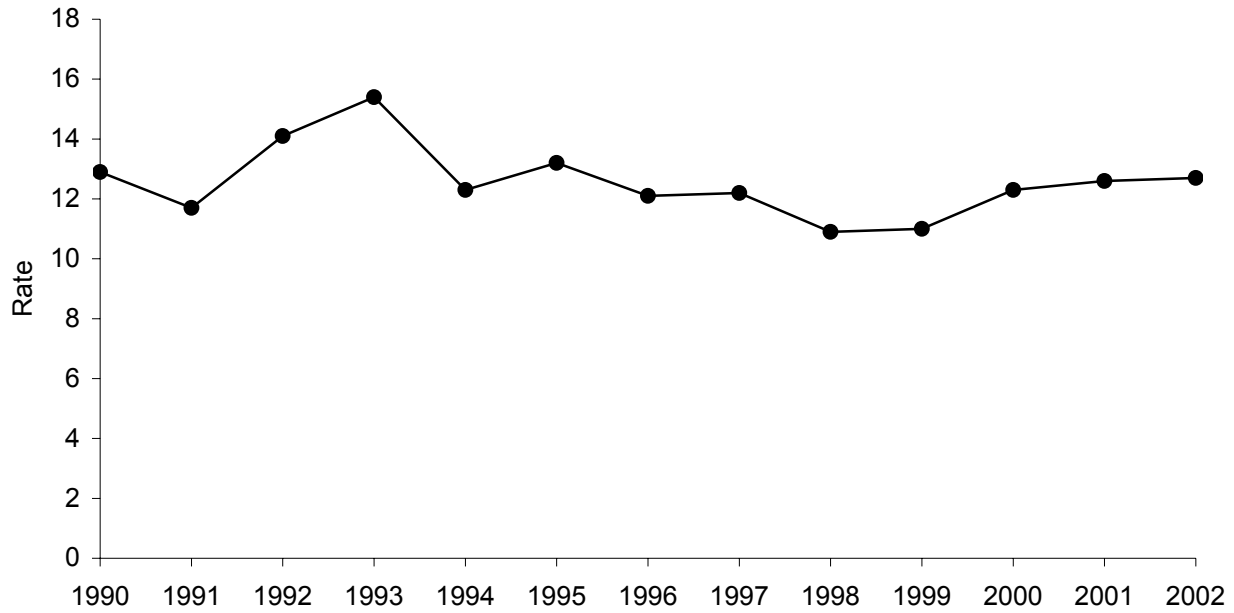
- 1 Rates are age adjusted to the 2000 US standard population by the direct standardization method. Hospitalization records with missing age are excluded.
- 2 Population estimates are taken from the Michigan population estimates for 2001.
- 3 Asthma hospitalization is defined as a primary discharge diagnosis of asthma, ICD-9-CM=493.XX.
- 4 Mid-Michigan is defined by the Mid-Michigan Asthma Coalition coverage area (Clinton, Eaton, Ingham Counties).

	Total Population
Mid-Michigan Rate	12.5
95% CI	11.9 , 13.1
Count	1,623
Michigan Rate	15.4
95% CI	15.3 , 15.6
Count	45,945

Data Source: Michigan Inpatient Database, Bureau of Epidemiology, MDCH.

- ✧ The average number of hospitalizations due to asthma per year in Mid-Michigan, 2000-2002, is 541.
- ✧ Mid-Michigan has significantly lower asthma hospitalization rates than the State of Michigan as a whole, 2000-2002.

Figure 2. Annual Rates (per 10,000) [1,2] of Asthma [3] Hospitalization, All Ages, for Mid-Michigan [4], 1990-2002.



- 1 Rates are age adjusted to the 2000 US standard population by the direct standardization method. Hospitalization records with missing age are excluded.
- 2 Population estimates are taken from the Michigan population estimates for 1990-2002.
- 3 Asthma hospitalization is defined as a primary discharge diagnosis of asthma, ICD-9-CM=493.XX.
- 4 Mid-Michigan is defined by the Mid-Michigan Asthma Coalition coverage area (Clinton, Eaton, Ingham Counties).

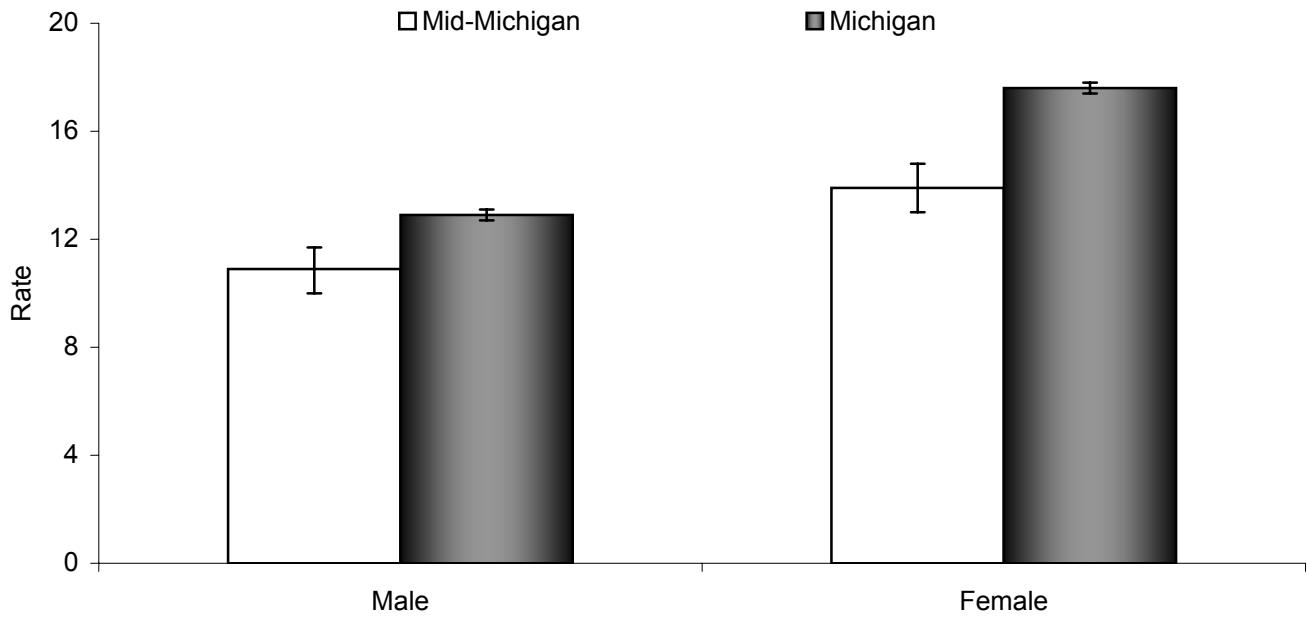
Year	Total Population	
	Rate	Count
1990	12.9	513
1991	11.7	481
1992	14.1	580
1993	15.4	653
1994	12.3	529
1995	13.2	569
1996	12.1	519
1997	12.2	527
1998	10.9	468
1999	11.0	473
2000	12.3	531
2001	12.6	544
2002	12.7	548

Data Source: Michigan Inpatient Database, Bureau of Epidemiology, MDCH.

✧ Between 1990 and 2002, there has not been a significant overall change in asthma hospitalization rates among persons in Mid-Michigan ($\rho = -0.29$, $p = 0.334$).

See appendix page 36 for supporting data.

Figure 3. Rates (per 10,000) [1,2] of Hospitalization due to Asthma [3] by Sex for Mid-Michigan [4] and the State of Michigan, All Ages, 2000-2002.



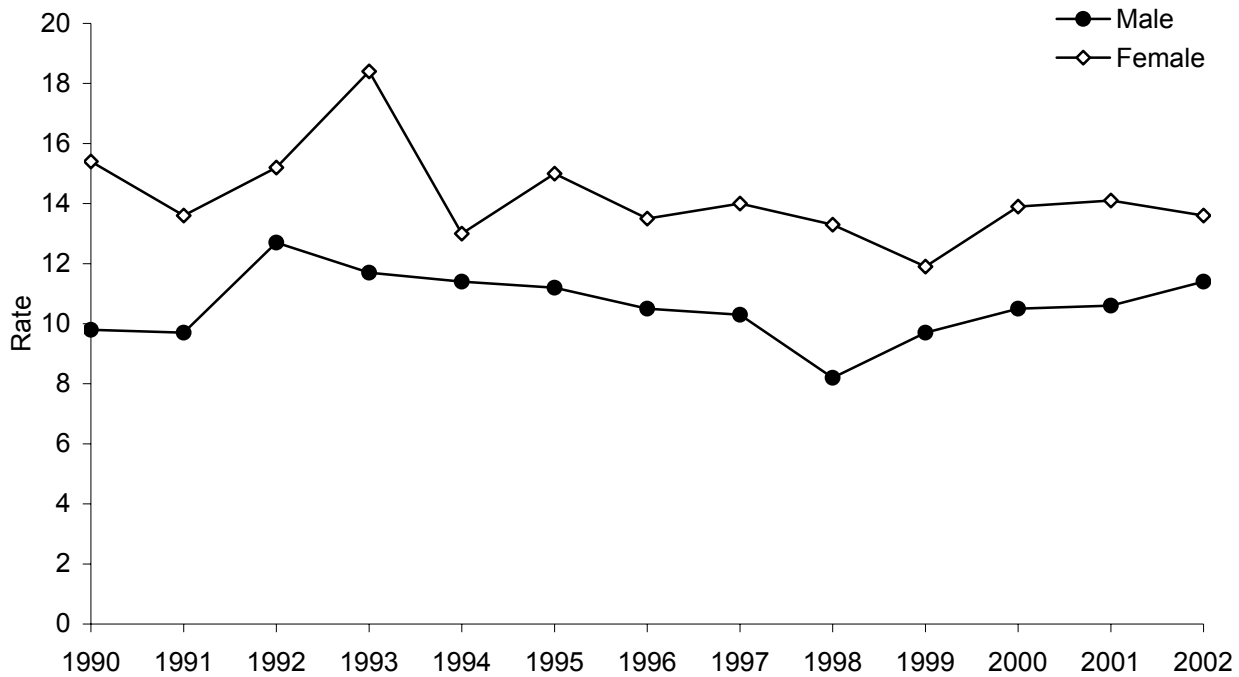
- 1 Rates are age adjusted to the 2000 US standard population by the direct standardization method. Hospitalization records with missing age are excluded.
- 2 Population estimates are taken from the Michigan population estimates for 2001.
- 3 Asthma hospitalization is defined as a primary discharge diagnosis of asthma, ICD-9-CM=493.XX.
- 4 Mid-Michigan is defined by the Mid-Michigan Asthma Coalition coverage area (Clinton, Eaton, Ingham Counties).

	Male	Female
Mid-Michigan Rate	10.9	13.9
95% CI	10.0 , 11.7	13.0 , 14.8
Count	693	930
Michigan Rate	12.9	17.6
95% CI	12.7 , 13.1	17.4 , 17.8
Count	18,987	26,958

Data Source: Michigan Inpatient Database, Bureau of Epidemiology, MDCH.

- ✧ The asthma hospitalization rates for males and females in Mid-Michigan are significantly lower than the respective rates for the State of Michigan as a whole, 2000-2002.
- ✧ In Mid-Michigan and the State of Michigan, females have significantly higher asthma hospitalization rates than males, 2000-2002.

Figure 4. Annual Rates (per 10,000) [1,2] of Asthma [3] Hospitalization by Sex, All Ages, for Mid-Michigan [4], 1990-2002.



- 1 Rates are age adjusted to the 2000 US standard population by the direct standardization method. Hospitalization records with missing age are excluded.
- 2 Population estimates are taken from the Michigan population estimates for 1990-2002.
- 3 Asthma hospitalization is defined as a primary discharge diagnosis of asthma, ICD-9-CM=493.XX.
- 4 Mid-Michigan is defined by the Mid-Michigan Asthma Coalition coverage area (Clinton, Eaton, Ingham Counties).

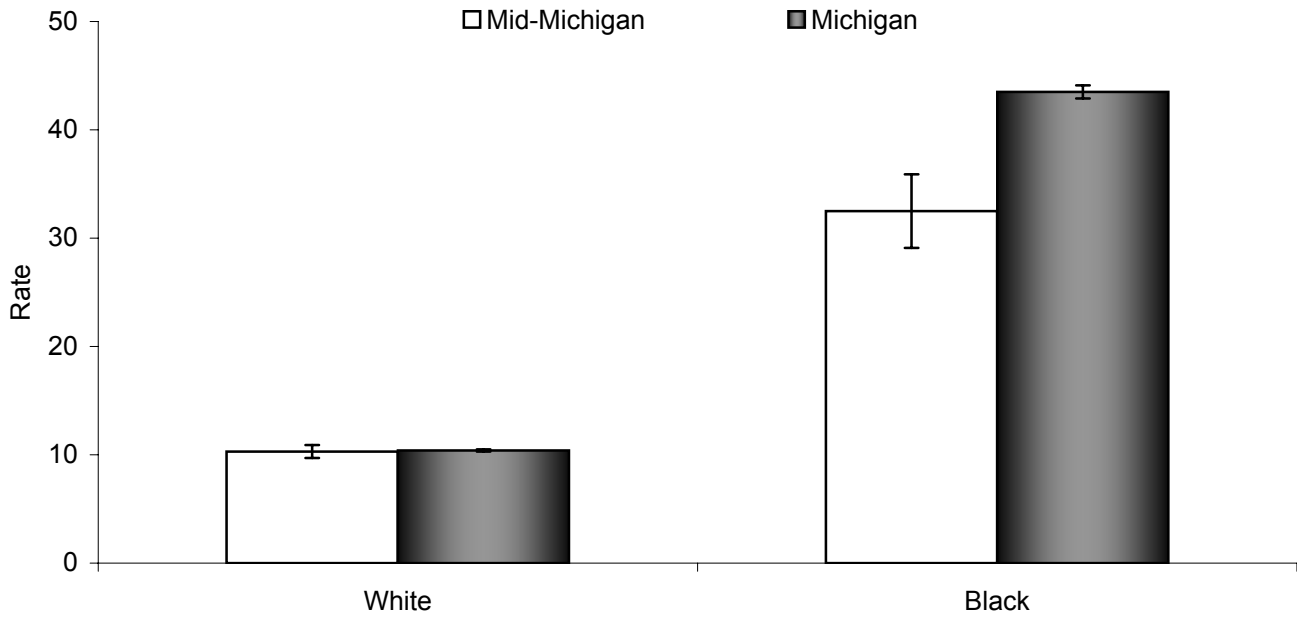
Year	Male		Female	
	Rate	Count	Rate	Count
1990	9.8	200	15.4	313
1991	9.7	190	13.6	291
1992	12.7	253	15.2	327
1993	11.7	250	18.4	403
1994	11.4	242	13.0	287
1995	11.2	235	15.0	334
1996	10.5	219	13.5	300
1997	10.3	217	14.0	310
1998	8.2	172	13.3	296
1999	9.7	208	11.9	265
2000	10.5	221	13.9	310
2001	10.6	229	14.1	315
2002	11.4	243	13.6	305

Data Source: Michigan Inpatient Database, Bureau of Epidemiology, MDCH.

✧ Between 1990 and 2001, there has not been a significant overall change in asthma hospitalization rates among the male or female population in Mid-Michigan (male, $\rho = -0.06$, $p = 0.844$; female, $\rho = -0.40$, $p = 0.171$).

See appendix pages 37 and 38 for supporting data.

Figure 5. Rates (per 10,000) [1,2] of Hospitalization due to Asthma [3] by Race [4] for Mid-Michigan [5] and the State of Michigan, All Ages, 2000-2002.



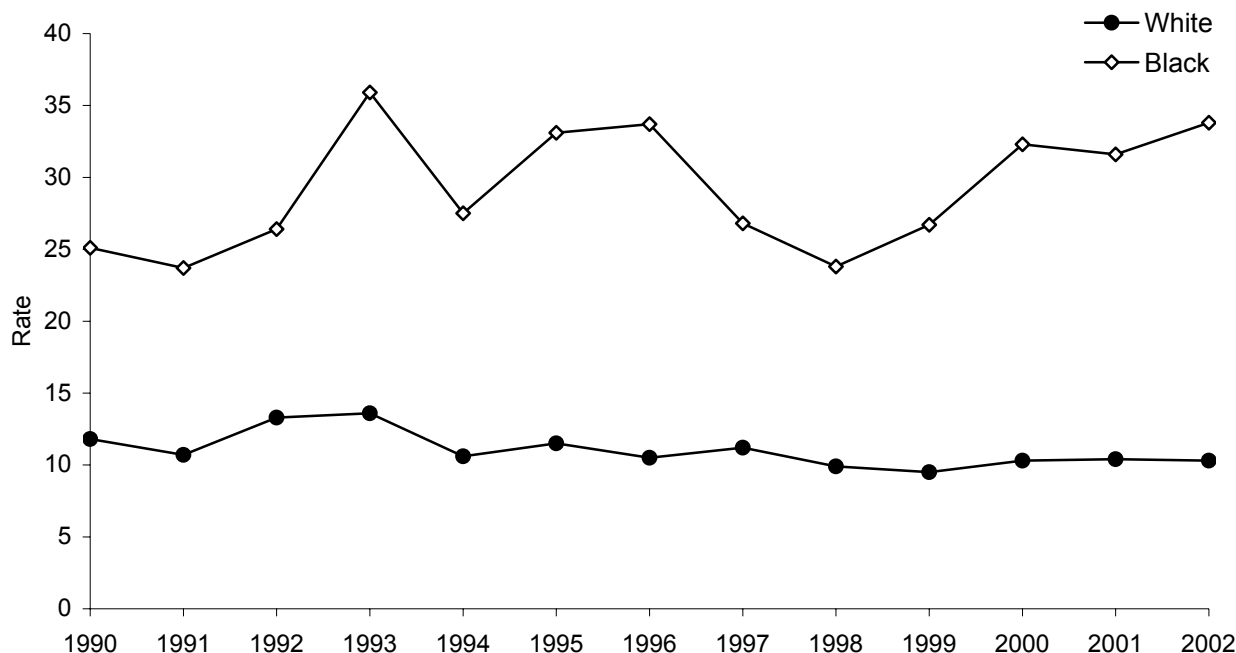
- 1 Rates are age adjusted to the 2000 US standard population by the direct standardization method. Hospitalization records with missing age are excluded.
- 2 Population estimates are taken from the Michigan population estimates for 2001.
- 3 Asthma hospitalization is defined as a primary discharge diagnosis of asthma, ICD-9-CM=493.XX.
- 4 For records that are missing data for race, race was assigned based on the 1990 census population for Michigan.
- 5 Mid-Michigan is defined by the Mid-Michigan Asthma Coalition coverage area (Clinton, Eaton, Ingham Counties).

	White	Black
Mid-Michigan Rate	10.3	32.5
95% CI	9.7 , 10.9	29.1 , 35.9
Count	1,148	426
Michigan Rate	10.4	43.5
95% CI	10.3 , 10.5	42.9 , 44.1
Count	25,455	19,685

Data Source: Michigan Inpatient Database, Bureau of Epidemiology, MDCH.

- ✧ In Mid-Michigan and the State of Michigan, white persons have significantly lower asthma hospitalization rates than black persons, 2000-2002.
- ✧ While black persons in the State of Michigan have a higher asthma hospitalization rate, white persons experience the greatest absolute burden of asthma hospitalization.

Figure 6. Annual Rates (per 10,000) [1,2] of Asthma [3] Hospitalization by Race [4], All Ages, for Mid-Michigan [5], 1990-2002.



- 1 Rates are age adjusted to the 2000 US standard population by the direct standardization method. Hospitalization records with missing age are excluded.
- 2 Population estimates are taken from the Michigan population estimates for 1990-2002.
- 3 Asthma hospitalization is defined as a primary discharge diagnosis of asthma, ICD-9-CM=493.XX.
- 4 For records that are missing data for race, race was assigned based on the 1990 census population for Michigan.
- 5 Mid-Michigan is defined by the Mid-Michigan Asthma Coalition coverage area (Clinton, Eaton, Ingham Counties).

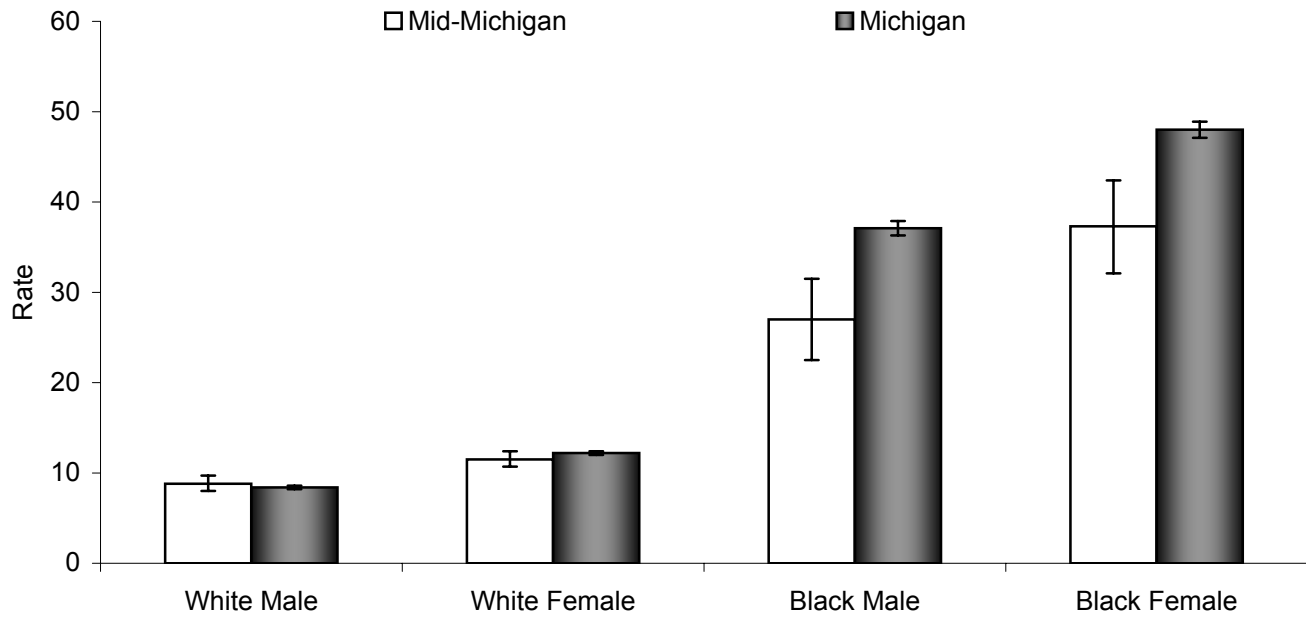
Year	White		Black	
	Rate	Count	Rate	Count
1990	11.8	421	25.1	75
1991	10.7	394	23.7	76
1992	13.3	491	26.4	82
1993	13.6	511	35.9	118
1994	10.6	399	27.5	100
1995	11.5	440	33.1	110
1996	10.5	396	33.7	107
1997	11.2	423	26.8	96
1998	9.9	376	23.8	87
1999	9.5	362	26.7	97
2000	10.3	382	32.3	134
2001	10.4	383	31.6	145
2002	10.3	383	33.8	147

Data Source: Michigan Inpatient Database, Bureau of Epidemiology, MDCH.

✧ Between 1990 and 2002, there has been a significant overall decrease in asthma hospitalization rates among the white population in Mid-Michigan ($\rho = -0.78$, $p < 0.01$).

See appendix pages 39 and 40 for supporting data.

Figure 7. Rates (per 10,000) [1,2] of Hospitalization due to Asthma [3] by Sex and Race [4] for Mid-Michigan [5] and the State of Michigan, All Ages, 2000-2002.



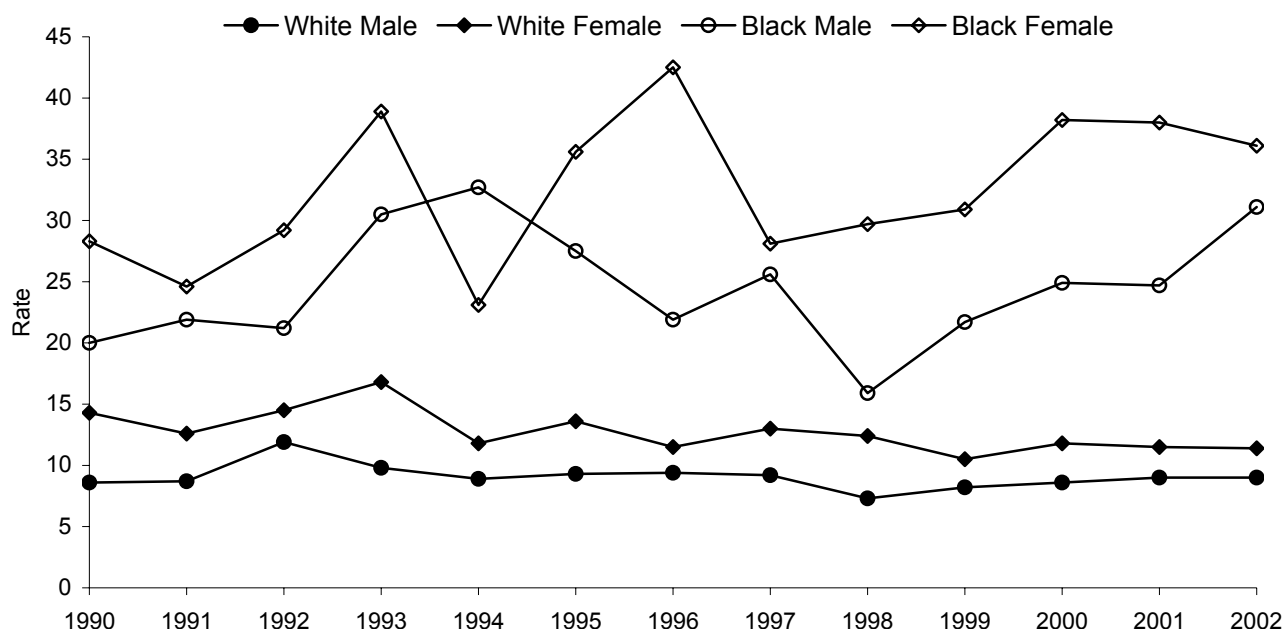
- 1 Rates are age adjusted to the 2000 US standard population by the direct standardization method. Hospitalization records with missing age are excluded.
- 2 Population estimates are taken from the Michigan population estimates for 2001.
- 3 Asthma hospitalization is defined as a primary discharge diagnosis of asthma, ICD-9-CM=493.XX.
- 4 For records that are missing data for race, race was assigned based on the 1990 census population for Michigan.
- 5 Mid-Michigan is defined by the Mid-Michigan Asthma Coalition coverage area (Clinton, Eaton, Ingham Counties).

	White Male	White Female	Black Male	Black Female
Mid-Michigan Rate	8.8	11.5	27.0	37.3
95% CI	8.0 , 9.7	10.7 , 12.4	22.5 , 31.5	32.1 , 42.4
Count	468	680	194	232
Michigan Rate	8.4	12.2	37.1	48.0
95% CI	8.2 , 8.6	12.0 , 12.4	36.3 , 37.9	47.1 , 48.9
Count	9,916	15,539	8,702	10,983

Data Source: Michigan Inpatient Database, Bureau of Epidemiology, MDCH.

- ✧ In Mid-Michigan, the asthma hospitalization rate for black females is significantly higher than the rates among white males, white females, or black males, 2000-2002.
- ✧ In Mid-Michigan, the asthma hospitalization rate for black persons is significantly higher than the rate among white persons, 2000-2002, regardless of sex.

Figure 8. Annual Rates (per 10,000) [1,2] of Asthma [3] Hospitalization by Sex and Race [4], All Ages, for Mid-Michigan [5], 1990-2002.



- 1 Rates are age adjusted to the 2000 US standard population by the direct standardization method. Hospitalization records with missing age are excluded.
- 2 Population estimates are taken from the Michigan population estimates for 1990-2002.
- 3 Asthma hospitalization is defined as a primary discharge diagnosis of asthma, ICD-9-CM=493.XX.
- 4 For records that are missing data for race, race was assigned based on the 1990 census population for Michigan.
- 5 Mid-Michigan is defined by the Mid-Michigan Asthma Coalition coverage area (Clinton, Eaton, Ingham Counties).

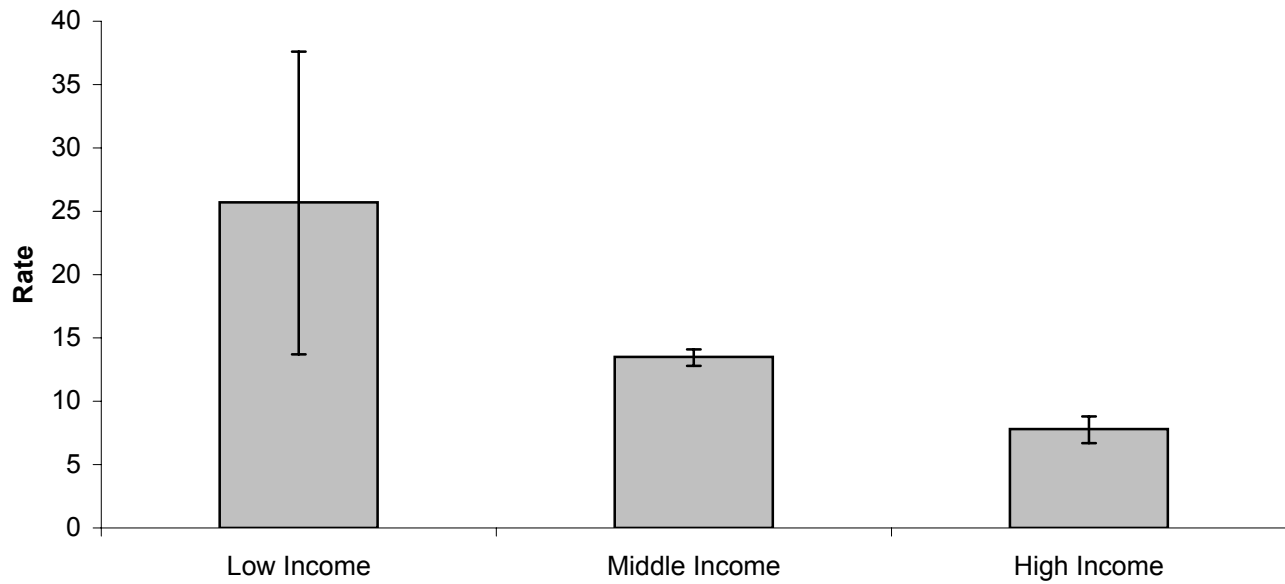
Year	White Male		White Female		Black Male		Black Female	
	Rate	Count	Rate	Count	Rate	Count	Rate	Count
1990	8.6	152	14.3	269	20.0	43	28.3	32
1991	8.7	151	12.6	243	21.9	36	24.6	40
1992	11.9	208	14.5	283	21.2	43	29.2	39
1993	9.8	179	16.8	332	30.5	59	38.9	59
1994	8.9	165	11.8	234	32.7	58	23.1	42
1995	9.3	168	13.6	272	27.5	58	35.6	52
1996	9.4	168	11.5	228	21.9	42	42.5	65
1997	9.2	167	13.0	256	25.6	47	28.1	49
1998	7.3	130	12.4	246	15.9	38	29.7	49
1999	8.2	152	10.5	210	21.7	46	30.9	51
2000	8.6	151	11.8	231	24.9	60	38.2	74
2001	9.0	159	11.5	224	24.7	62	38.0	83
2002	9.0	158	11.4	225	31.1	72	36.1	75

Data Source: Michigan Inpatient Database, Bureau of Epidemiology, MDCH.

✧ Between 1990 and 2002, there has been a significant overall decrease in asthma hospitalization rates among the white female population in Mid-Michigan ($\rho = -0.75, p < 0.01$).

See appendix pages 41 through 44 for supporting data.

Figure 9. Rates (per 10,000) [1,2] of Hospitalization due to Asthma [3] by Income [4] for Mid-Michigan [5], 2000-2002.



1 Rates are age adjusted to the 2000 US standard population by the direct standardization method. Hospitalization records with missing age are excluded.

2 Populations are taken from the 2000 US Census.

3 Asthma hospitalization is defined as a primary discharge diagnosis of asthma, ICD-9-CM=493.XX.

4 High income = top 20% of Michigan's zip code areas, as determined by median household income from Census 2000; Low income = bottom 20% of Michigan's zip code areas, as determined by median household income from Census 2000; all others are considered middle income.

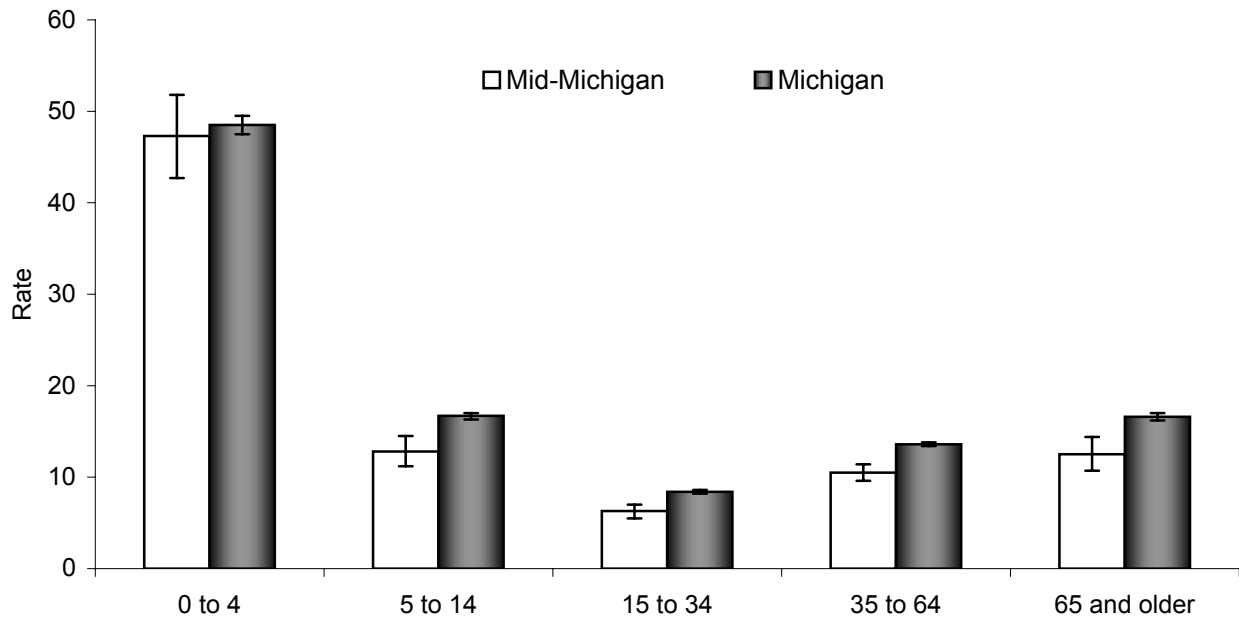
5 Mid-Michigan is defined by the Mid-Michigan Asthma Coalition coverage area (Clinton, Eaton, Ingham Counties).

	Low Income	Middle Income	High Income
Mid-Michigan Rate	25.7	13.5	7.8
95% CI	13.7 , 37.6	12.8 , 14.1	6.7 , 8.8
Count	21	1,509	219

Data Source: Michigan Inpatient Database, Bureau of Epidemiology, MDCH.

✧ In Mid-Michigan, the asthma hospitalization rate for high income areas is significantly lower than the rate for low or middle income areas, 2000-2002.

Figure 10. Rates (per 10,000) [1] of Hospitalization due to Asthma [2] by Age Group for Mid-Michigan [3] and the State of Michigan, 2000-2002.



1 Population estimates are taken from the Michigan population estimates for 2001.

2 Asthma hospitalization is defined as a primary discharge diagnosis of asthma, ICD-9-CM=493.XX.

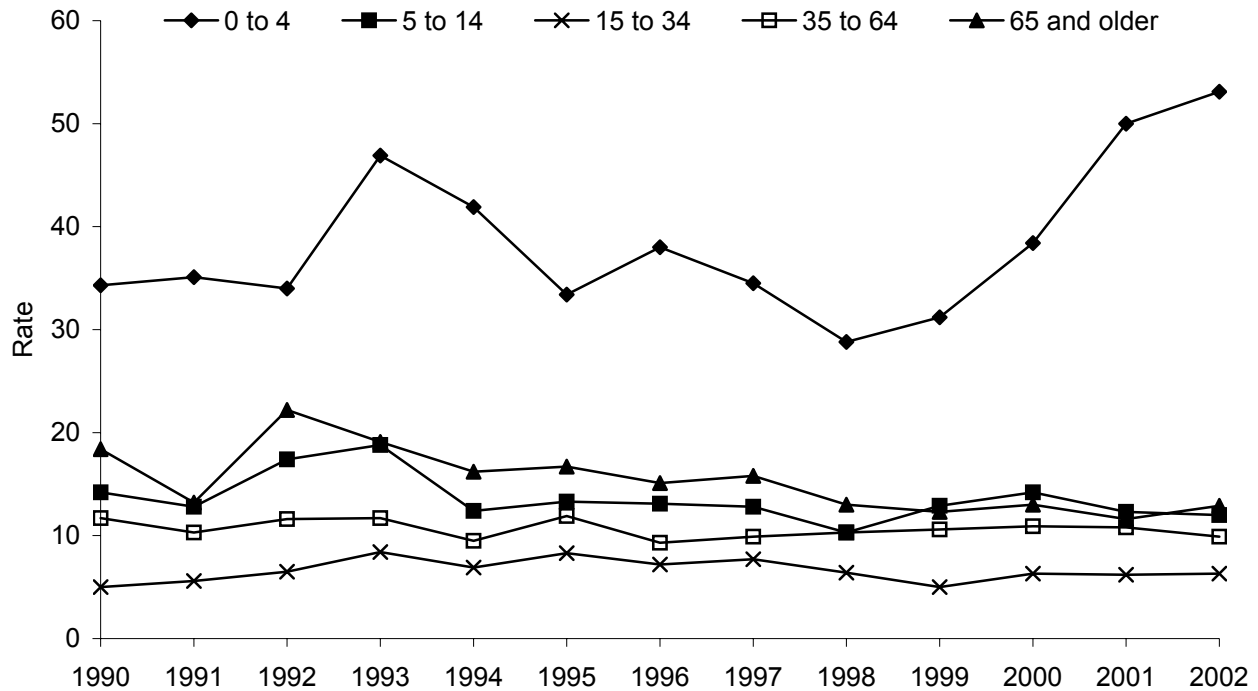
3 Mid-Michigan is defined by the Mid-Michigan Asthma Coalition coverage area (Clinton, Eaton, Ingham Counties).

	0 to 4	5 to 14	15 to 34	35 to 64	65 and older
Mid-Michigan Rate	47.3	12.8	6.3	10.5	12.5
95% CI	42.7 , 51.8	11.2 , 14.5	5.5 , 7.0	9.6 , 11.4	10.7 , 14.4
Count	408	239	275	529	172
Michigan Rate	48.5	16.7	8.4	13.6	16.6
95% CI	47.5 , 49.5	16.3 , 17.0	8.2 , 8.6	13.4 , 13.8	16.2 , 17.0
Count	9,637	7,375	6,859	15,964	6,110

Data Source: Michigan Inpatient Database, Bureau of Epidemiology, MDCH.

- ✧ For Mid-Michigan and the State of Michigan, children aged 0 to 4 years have significantly higher rates of asthma hospitalization than all other age groups, 2000-2002.
- ✧ For Mid-Michigan and the State of Michigan, persons aged 15 to 34 years have significantly lower rates of asthma hospitalization than all other age groups, 2000-2002.

Figure 11. Annual Rates (per 10,000) [1] of Asthma [2] Hospitalization by Age Group for Mid-Michigan [3], 1990-2002.



1 Population estimates are taken from the Michigan population estimates for 1990-2002.

2 Asthma hospitalization is defined as a primary discharge diagnosis of asthma, ICD-9-CM=493.XX.

3 Mid-Michigan is defined by the Mid-Michigan Asthma Coalition coverage area (Clinton, Eaton, Ingham Counties).

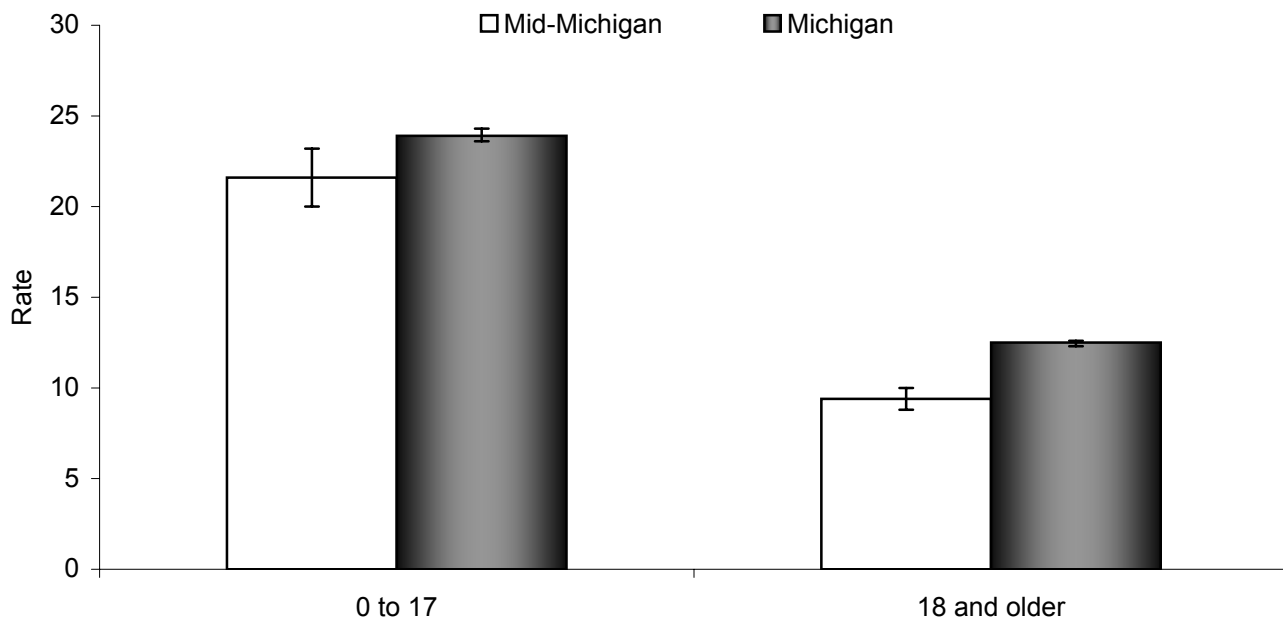
Year	0 to 4		5 to 14		15 to 34		35 to 64		65 and older	
	Rate	Count	Rate	Count	Rate	Count	Rate	Count	Rate	Count
1990	34.3	110	14.2	87	5.0	81	11.7	163	18.4	72
1991	35.1	113	12.8	80	5.6	89	10.3	146	13.2	53
1992	34.0	109	17.4	109	6.5	102	11.6	169	22.2	91
1993	46.9	149	18.8	118	8.4	132	11.7	174	19.1	80
1994	41.9	131	12.4	78	6.9	107	9.5	144	16.2	69
1995	33.4	102	13.3	84	8.3	127	11.9	184	16.7	72
1996	38.0	114	13.1	83	7.2	109	9.3	147	15.1	66
1997	34.5	102	12.8	81	7.7	116	9.9	158	15.8	70
1998	28.8	84	10.3	65	6.4	95	10.3	166	13.0	58
1999	31.2	90	12.9	81	5.0	73	10.6	174	12.3	55
2000	38.4	111	14.2	89	6.3	92	10.9	180	13.0	59
2001	50.0	144	12.3	76	6.2	90	10.8	181	11.6	53
2002	53.1	153	12.0	74	6.3	93	9.9	168	12.9	60

Data Source: Michigan Inpatient Database, Bureau of Epidemiology, MDCH.

✧ Between 1990 and 2002, there has been a significant overall decrease in asthma hospitalization rates among the population aged 65 and older in Mid-Michigan ($\rho = -0.81$, $p < 0.01$).

See appendix pages 45 through 49 for supporting data.

Figure 12. Rates (per 10,000) [1,2] of Hospitalization due to Asthma [3] by Age Group for Mid-Michigan [4] and the State of Michigan, 2000-2002.



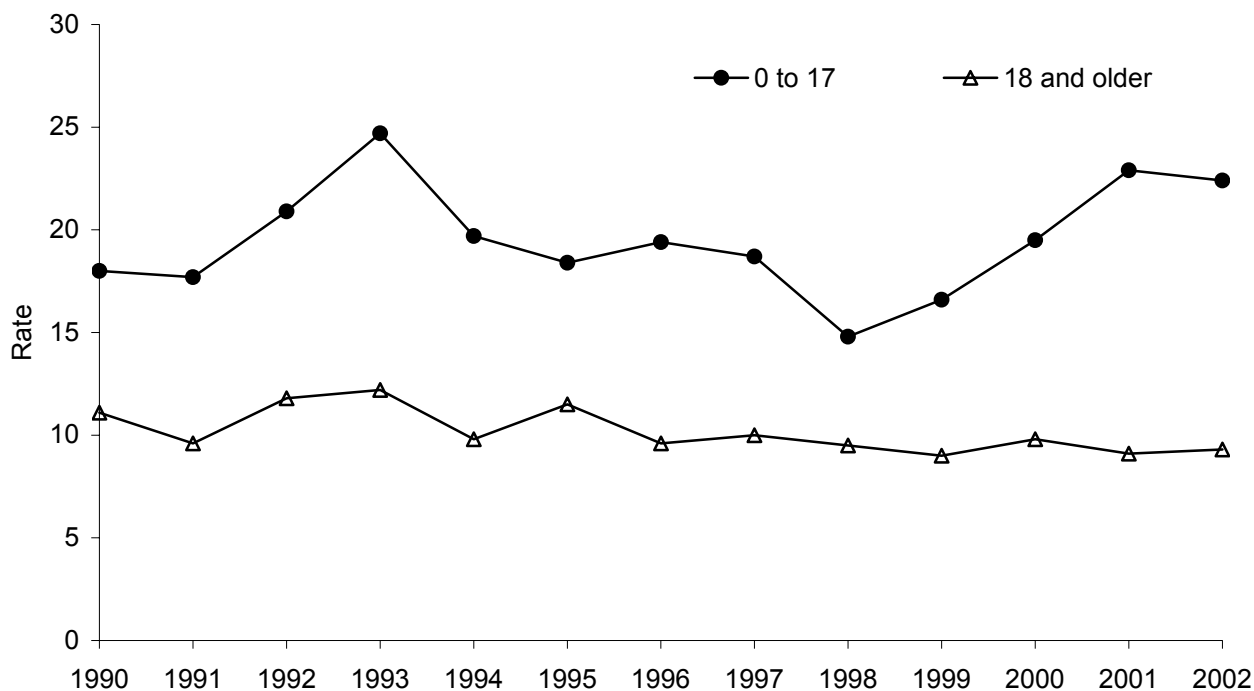
- 1 Rates are age adjusted to the 2000 US standard population by the direct standardization method. Hospitalization records with missing age are excluded.
- 2 Population estimates are taken from the Michigan population estimates for 2001.
- 3 Asthma hospitalization is defined as a primary discharge diagnosis of asthma, ICD-9-CM=493.XX.
- 4 Mid-Michigan is defined by the Mid-Michigan Asthma Coalition coverage area (Clinton, Eaton, Ingham Counties).

	0 to 17	18 and Older
Mid-Michigan Rate	21.6	9.4
95% CI	20.0 , 23.2	8.8 , 10.0
Count	704	919
Michigan Rate	23.9	12.5
95% CI	23.6 , 24.3	12.3 , 12.6
Count	18,141	27,804

Data Source: Michigan Inpatient Database, Bureau of Epidemiology, MDCH.

- ✧ For Mid-Michigan and the State of Michigan, the rates of asthma hospitalization for children less than 18 years of age are significantly higher than those for adults aged 18 years and older, 2000-2002.
- ✧ The rates of asthma hospitalization for children less than 18 years of age and adults aged 18 years and older in Mid-Michigan are significantly lower than the respective rates for the State of Michigan as a whole, 2000-2002.

Figure 13. Annual Rates (per 10,000) [1,2] of Asthma [3] Hospitalization by Age Group for Mid-Michigan [4], 1990-2002.



- 1 Rates are age adjusted to the 2000 US standard population by the direct standardization method. Hospitalization records with missing age are excluded.
- 2 Population estimates are taken from the Michigan population estimates for 1990-2002.
- 3 Asthma hospitalization is defined as a primary discharge diagnosis of asthma, ICD-9-CM=493.XX.
- 4 Mid-Michigan is defined by the Mid-Michigan Asthma Coalition coverage area (Clinton, Eaton, Ingham Counties).

Year	0 to 17		18 and Older	
	Rate	Count	Rate	Count
1990	18.0	205	11.1	308
1991	17.7	204	9.6	277
1992	20.9	239	11.8	341
1993	24.7	284	12.2	369
1994	19.7	226	9.8	303
1995	18.4	208	11.5	361
1996	19.4	218	9.6	301
1997	18.7	209	10.0	318
1998	14.8	164	9.5	304
1999	16.6	182	9.0	291
2000	19.5	213	9.8	318
2001	22.9	249	9.1	295
2002	22.4	242	9.3	306

Data Source: Michigan Inpatient Database, Bureau of Epidemiology, MDCH.

✧ Between 1990 and 2002, there has been a significant overall decrease in asthma hospitalization rates among persons aged 18 and older in Mid-Michigan ($\rho = -0.67$, $p < 0.05$).

See appendix pages 50 and 51 for supporting data.

Rates (per 10,000) [1,2] of Hospitalization due to Asthma [3] by Zip Code of Residence, Mid-Michigan [4], All Ages, 2000-2002.

Zip Code	Count	Rate	95% Confidence Interval	
			Lower Limit	Upper Limit
48808	19	‡	‡	‡
48813	54	9.0	6.6	11.4
48819	7	‡	‡	‡
48820	28	7.4	4.5	10.3
48821	18	‡	‡	‡
48822	~	‡	‡	‡
48823	69	7.2	5.4	8.9
48824	~	‡	‡	‡
48827	39	9.5	6.4	12.5
48831	12	‡	‡	‡
48835	11	‡	‡	‡
48837	41	8.0	5.5	10.4
48840	40	11.8	8.1	15.5
48842	73	13.1	10.1	16.2
48845	12	‡	‡	‡
48848	15	‡	‡	‡
48849	7	‡	‡	‡
48853	~	‡	‡	‡
48854	34	7.2	4.8	9.7
48861	5	‡	‡	‡
48864	34	6.4	4.2	8.6
48866	7	‡	‡	‡
48872	36	15.4	10.3	20.5
48873	7	‡	‡	‡
48875	20	‡	‡	‡
48876	6	‡	‡	‡
48879	42	8.1	5.6	10.6
48890	~	‡	‡	‡
48892	15	‡	‡	‡
48894	~	‡	‡	‡
48895	24	7.5	4.5	10.5
48897	~	‡	‡	‡
48906	158	19.3	16.3	22.3
48910	176	16.4	13.9	18.9
48911	280	22.2	19.6	24.9
48912	118	21.4	17.5	25.4
48915	107	35.5	28.7	42.4
48917	111	12.5	10.2	14.9

Note: Table continued on next page.

(continued from previous page)

48933	18	‡	‡	‡
49021	12	‡	‡	‡
49073	17	‡	‡	‡
49076	5	‡	‡	‡
49096	7	‡	‡	‡
49251	19	‡	‡	‡
49264	5	‡	‡	‡
49284	10	‡	‡	‡
49285	12	‡	‡	‡
Mid-Michigan	1,623	12.5	11.9	13.1

1 Rates are age adjusted to the 2000 US standard population by the direct standardization method. Hospitalization records with missing age are excluded.

2 Populations are taken from the 2000 US Census.

3 Asthma hospitalization is defined as a primary discharge diagnosis of asthma, ICD-9-CM=493.XX.

4 Mid-Michigan is defined by the Mid-Michigan Asthma Coalition coverage area (Clinton, Eaton, Ingham Counties).

‡ Insufficient data to compute a stable rate (number of events ≤20 or population <5000).

~ Number of hospitalizations <5.

Data Source: Michigan Inpatient Database, Bureau of Epidemiology, MDCH.

Section 3: Asthma Mortality

Successful asthma management reduces symptoms and improves quality of life. Failure to maintain good control of the disease results in a higher risk of mortality. Death due to asthma is a rare and preventable event, indicative of difficulty in self-management and/or access to care.

Mortality data are acquired from the Michigan Resident Death Files for the years 1990 to 2003. This database includes all deaths in Michigan and deaths of Michigan residents where the death occurred out-of-state. As recommended by the Council for State and Territorial Epidemiologists (Position Statement 1998-EH/CD 1), deaths where asthma is primary cause are selected from these data. From 1990 to 1998, these are deaths with primary cause coded to International Classification of Disease (ICD) Version-9 codes 493.XX. Deaths occurring from 1999 to 2003 are classified according to ICD Version 10; ICD-10 codes for asthma are J45 and J46. The ICD-10 coding scheme is different and more detailed than its predecessor, ICD-9. Deaths coded with ICD-10 are not directly comparable to deaths coded with ICD-9.

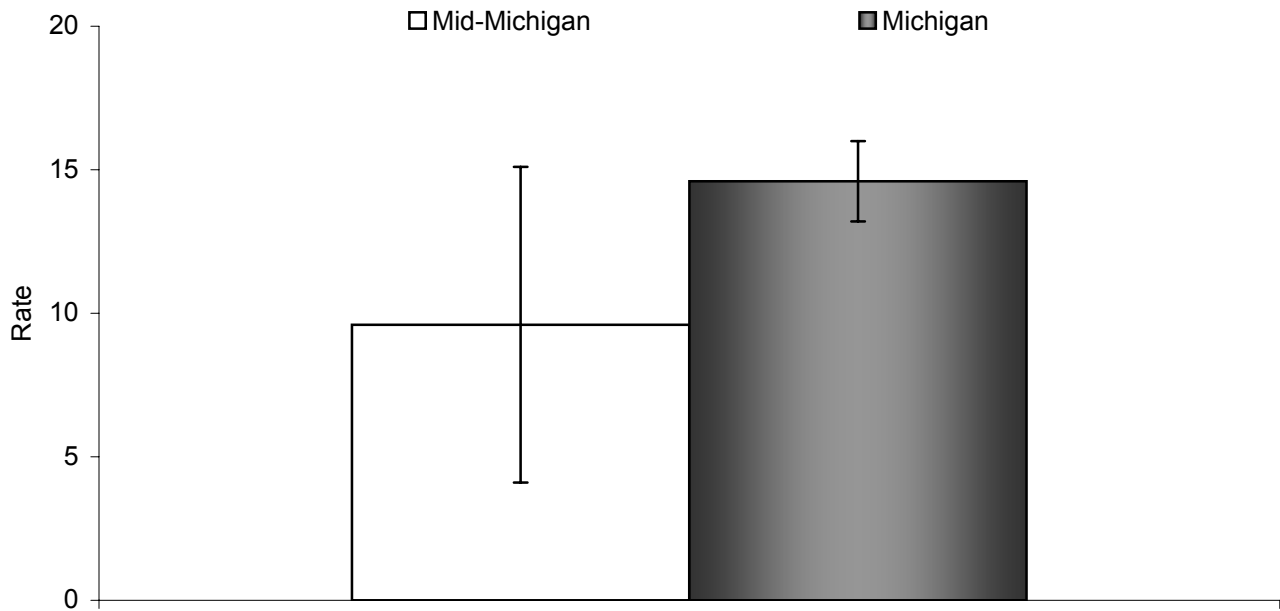
While a comparability ratio between ICD-9 and ICD-10 exists for asthma (0.8938; that is, for every 100 asthma deaths coded with ICD-9, only 89.38 would be coded as asthma using ICD-10), the analysis presented here does not attempt to compare pre-1999 data with asthma death occurring since 1999. (Anderson RN, *et al.* National Vital Statistics Reports; 49(2). 2001)

Age-adjusted asthma mortality rates are calculated and presented per 1,000,000 population. Rates are age adjusted so that valid comparisons can be made between populations of different age distributions. Mortality rates for demographic units with a small number of events (less than 5 events) or a small population size (less than 5,000 population) are not calculated because these rates are statistically unstable. In addition, to protect the identity of the deceased, counts less than 5 are not presented in this report.

Ninety five percent confidence intervals are computed for asthma mortality rates where more than one year of data are combined. The confidence interval estimates the statistical uncertainty of the mortality rate and can be used to test whether rates are statistically different between groups. Average asthma mortality rates are considered statistically different between groups if their 95% confidence intervals do not overlap. This technique is used to compare rates for demographic subpopulations, such as male versus female, and geographical subpopulations, such as county versus state.

Due to the difference in asthma mortality coding between pre-1999 and 1999-present data, trend analyses were not conducted.

Figure 14. Rates (per 1,000,000) [1,2] of Mortality due to Asthma [3] for Mid-Michigan [4] and the State of Michigan, All Ages, 2001-2003.



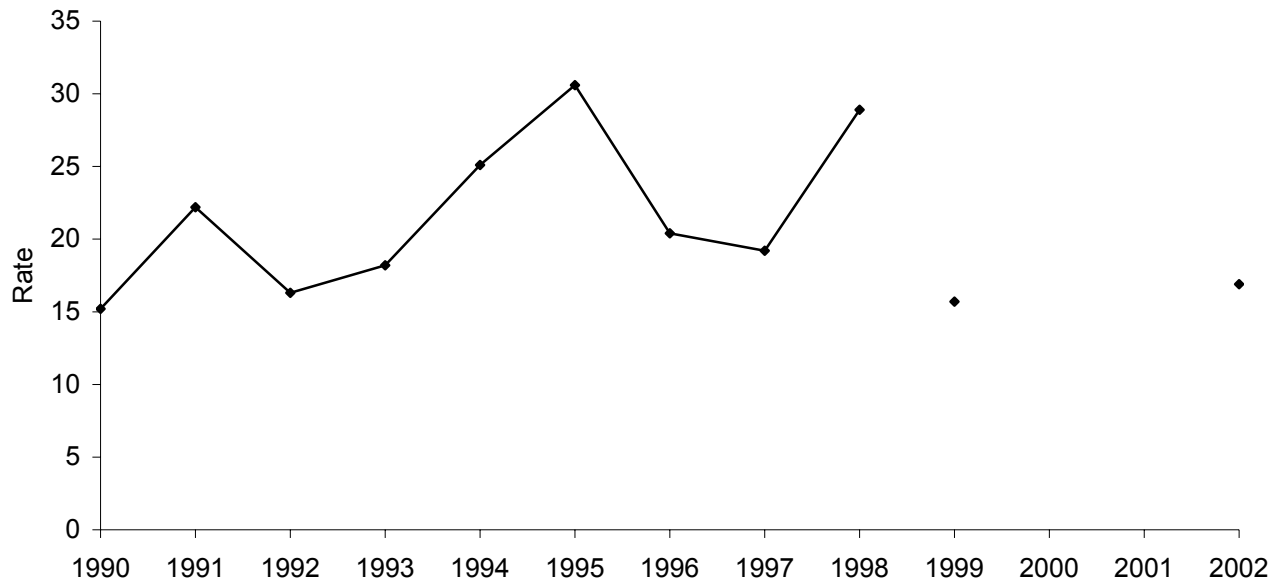
- 1 Rates are age adjusted to the 2000 US standard population by the direct standardization method.
- 2 Population estimates are taken from the Michigan population estimates for 2002.
- 3 Asthma death is defined as a primary cause of death as asthma, ICD-10=J45 or J46.
- 4 Mid-Michigan is defined by the Mid-Michigan Asthma Coalition coverage area (Clinton, Eaton, Ingham Counties).

	Total Population
Mid-Michigan Rate	9.6
95% CI	4.1 , 15.1
Count	12
Michigan Rate	14.6
95% CI	13.2 , 16.0
Count	441

Data Source: Michigan Resident Death Files, Bureau of Epidemiology, MDCH.

- ✧ The average number of deaths due to asthma per year in Michigan, 2001-2003, is 147.
- ✧ The rate of asthma mortality in Mid-Michigan is not significantly different than the rate for the State of Michigan as a whole, 2001-2003.

Figure 15. Annual Rates (per 1,000,000) [1,2] of Mortality due to Asthma [3], All Ages, for Mid-Michigan [4], 1990-2002 [5].



- 1 Rates are age adjusted to the 2000 US standard population by the direct standardization method.
- 2 Population estimates are taken from the Michigan population estimates for 1990-2002.
- 3 Asthma death is defined as a primary cause of death as asthma, ICD-9=493.XX and ICD-10=J45 or J46.
- 4 Mid-Michigan is defined by the Mid-Michigan Asthma Coalition coverage area (Clinton, Eaton, Ingham Counties).
- 5 Due to a change in coding for asthma deaths beginning in 1999, rates calculated for 1999-2002 are not comparable to rates calculated for 1990-1998.

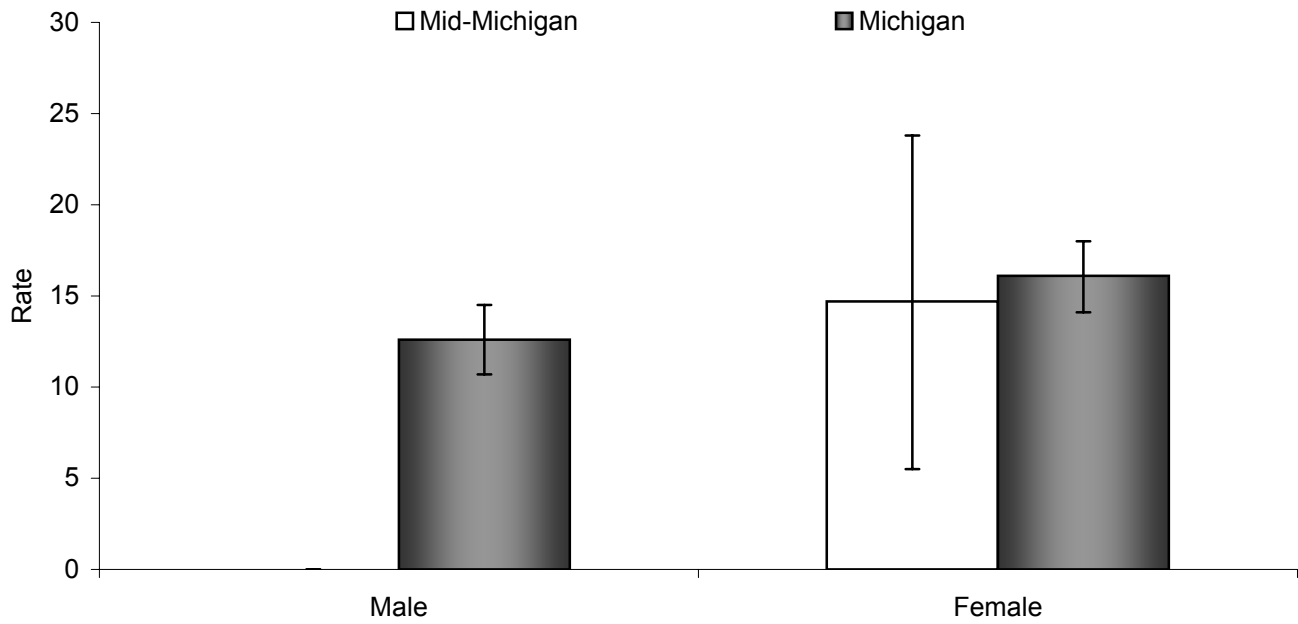
Year	Total Population	
	Rate	Count
1990	15.2	6
1991	22.2	8
1992	16.3	5
1993	18.2	6
1994	25.1	9
1995	30.6	11
1996	20.4	8
1997	19.2	7
1998	28.9	11
1999	15.7	7
2000	‡	~
2001	‡	~
2002	16.9	7

- ‡ Insufficient data to compute a stable rate (number of events <5 or population <5000).
 ~ Due to a low number of events (<5), results are suppressed to protect the identity of the deceased.

Data Source: Michigan Resident Death Files, Bureau of Epidemiology, MDCH.

See appendix page 55 for supporting data.

Figure 16. Rates (per 1,000,000) [1,2] of Mortality due to Asthma [3] by Sex for Mid-Michigan [4] and the State of Michigan, All Ages, 2001-2003.



- 1 Rates are age adjusted to the 2000 US standard population by the direct standardization method.
- 2 Population estimates are taken from the Michigan population estimates for 2002.
- 3 Asthma death is defined as a primary cause of death as asthma, ICD-10=J45 or J46.
- 4 Mid-Michigan is defined by the Mid-Michigan Asthma Coalition coverage area (Clinton, Eaton, Ingham Counties).

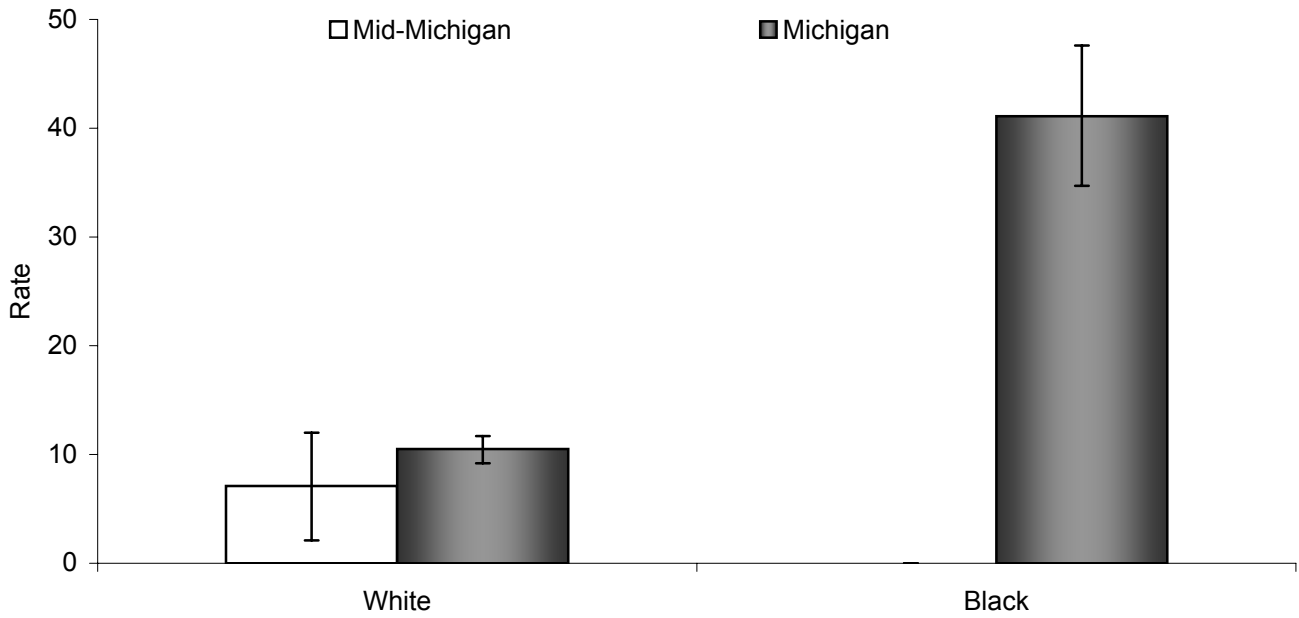
	Male	Female
Mid-Michigan Rate	‡	14.7
95% CI	‡ , ‡	5.5 , 23.8
Count	~	10
Michigan Rate	12.6	16.1
95% CI	10.7 , 14.5	14.1 , 18.0
Count	171	270

- ‡ Insufficient data to compute a stable rate (number of events <5 or population <5000).
 ~ Due to a low number of events (<5), results are suppressed to protect the identity of the deceased.

Data Source: Michigan Resident Death Files, Bureau of Epidemiology, MDCH.

- ✧ The rate of asthma mortality for females in Mid-Michigan is not significantly different than the rate for the State of Michigan as a whole, 2001-2003.
- ✧ For the State of Michigan, the rate of asthma mortality for females is not significantly different than the rate for males, 2001-2003.

Figure 17. Rates (per 1,000,000) [1,2] of Mortality due to Asthma [3] by Race for Mid-Michigan [4] and the State of Michigan, All Ages, 2001-2003.



- 1 Rates are age adjusted to the 2000 US standard population by the direct standardization method.
- 2 Population estimates are taken from the Michigan population estimates for 2002.
- 3 Asthma death is defined as a primary cause of death as asthma, ICD-10=J45 or J46.
- 4 Mid-Michigan is defined by the Mid-Michigan Asthma Coalition coverage area (Clinton, Eaton, Ingham Counties).

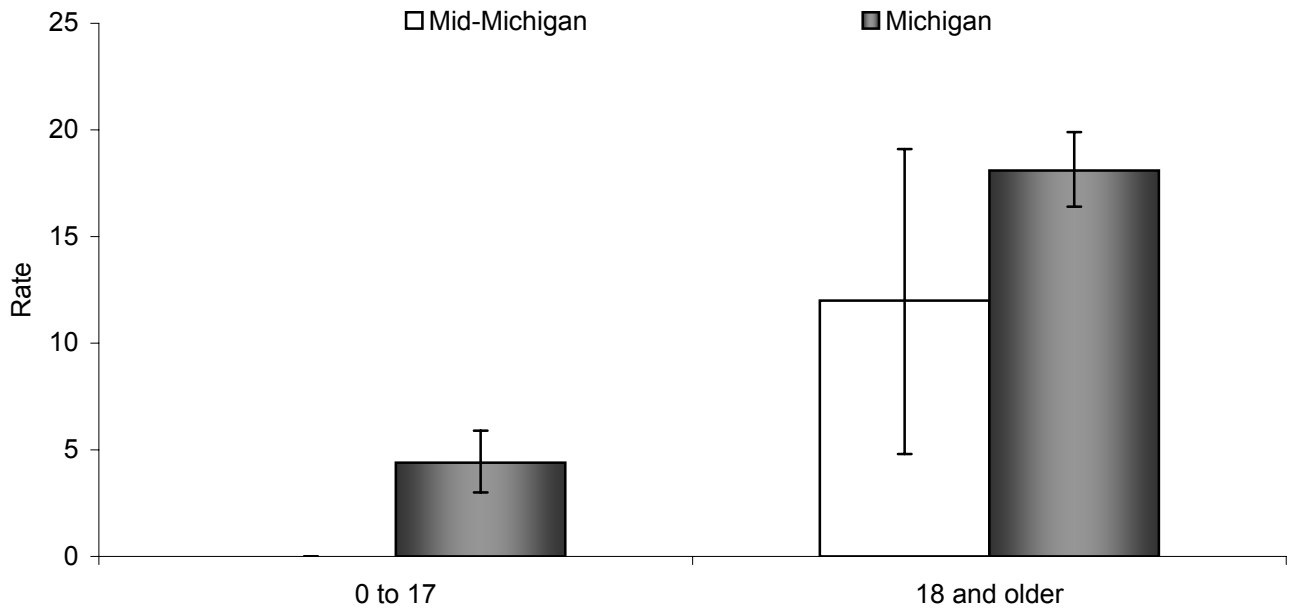
	White	Black
Mid-Michigan Rate	7.1	‡
95% CI	2.1 , 12.0	‡ , ‡
Count	8	~
Michigan Rate	10.5	41.1
95% CI	9.2 , 11.7	34.7 , 47.6
Count	273	163

- ‡ Insufficient data to compute a stable rate (number of events <5 or population <5000).
- ~ Due to a low number of events (<5), results are suppressed to protect the identity of the deceased.

Data Source: Michigan Resident Death Files, Bureau of Epidemiology, MDCH.

- ✧ While black persons in the State of Michigan have a significantly higher asthma mortality rate, white persons experience more asthma related deaths, 2001-2003.
- ✧ The rate of asthma mortality for white persons in Mid-Michigan is not significantly different than the rate for the State of Michigan as a whole, 2001-2003.

Figure 18. Rates (per 1,000,000) [1,2] of Mortality due to Asthma [3] by Age Group for Mid-Michigan [4] and the State of Michigan, 2001-2003.



- 1 Rates are age adjusted to the 2000 US standard population by the direct standardization method.
- 2 Population estimates are taken from the Michigan population estimates for 2002.
- 3 Asthma death is defined as a primary cause of death as asthma, ICD-10=J45 or J46.
- 4 Mid-Michigan is defined by the Mid-Michigan Asthma Coalition coverage area (Clinton, Eaton, Ingham Counties).

	0 to 17	18 and Older
Mid-Michigan Rate	‡	12.0
95% CI	‡ , ‡	4.8 , 19.1
Count	~	11
Michigan Rate	4.4	18.1
95% CI	3.0 , 5.9	16.4 , 19.9
Count	35	406

- ‡ Insufficient data to compute a stable rate (number of events <5 or population <5000).
 ~ Due to a low number of events (<5), results are suppressed to protect the identity of the deceased.

Data Source: Michigan Resident Death Files, Bureau of Epidemiology, MDCH.

- ✧ The asthma mortality rate in the State of Michigan is significantly higher for individuals aged 18 years and older than for individuals aged less than 18 years, 2001-2003.
- ✧ The rate of asthma mortality for persons aged 18 years and older in Mid-Michigan is not significantly different than the rate for the State of Michigan as a whole, 2001-2003.

Section 4: *Healthy People 2010* Objectives for Asthma

The U.S. Department of Health and Human Services has developed *Healthy People 2010*, a set of disease prevention and health promotion objectives for the nation to achieve over the first decade of the new century. Although neither the United States nor Michigan have met all the *Healthy People 2010* targets for asthma, Michigan has had some success in reaching particular asthma objectives for some populations. For more information about the *Healthy People 2010* initiative, visit their website: <http://www.healthypeople.gov>.

The following asthma hospitalization and mortality figures provide information for Clinton, Eaton, and Ingham Counties, Mid-Michigan, and the State of Michigan, as compared to the *Healthy People 2010* targets for asthma.

Selected *Healthy People 2010* Objectives Related to Asthma for which Mid-Michigan Data are Available for Comparison.

Objective 1-9a: Reduce hospitalization rates for three ambulatory-care-sensitive conditions: pediatric asthma, uncontrolled diabetes, and immunization preventable pneumonia and influenza.

Target: 17.3 per 10,000 (age 0-17 years)

Objective 24-1: Reduce asthma deaths.

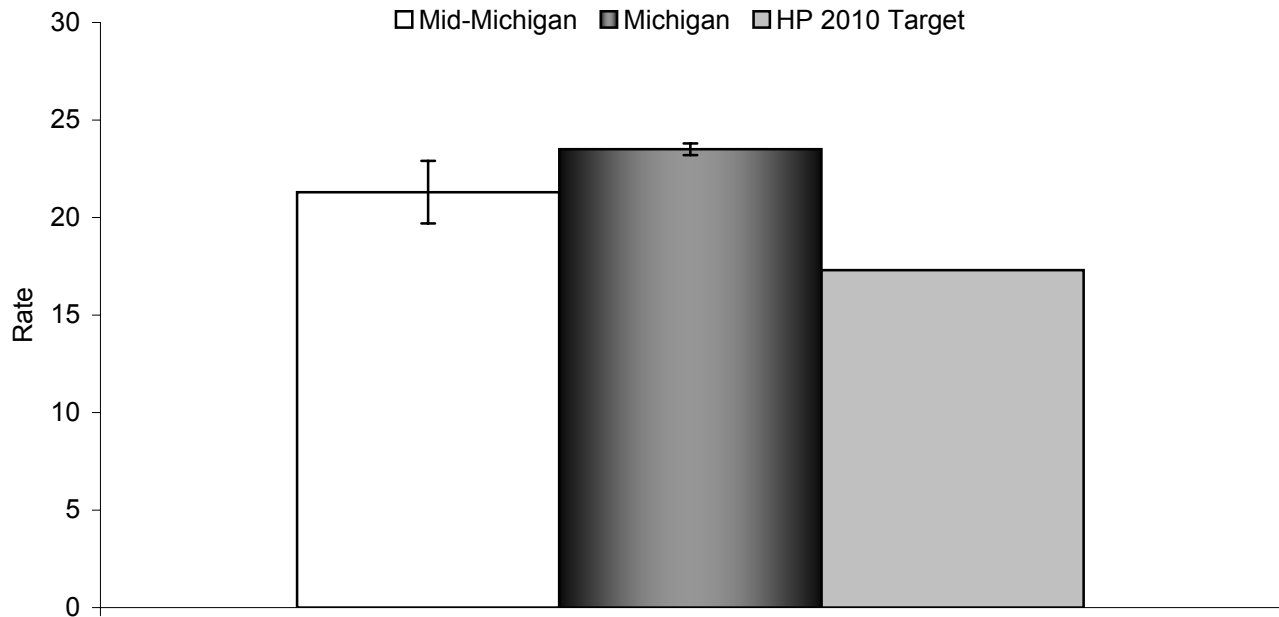
Targets: 1 per 1,000,000 (age 0-4 years)
1 per 1,000,000 (age 5-14 years)
2 per 1,000,000 (age 15-34 years)
9 per 1,000,000 (age 35-64 years)
60 per 1,000,000 (age ≥65 years)

Objective 24-2: Reduce hospitalizations for asthma.

Targets: 25 per 10,000 (age 0-4 years)
7.7 per 10,000 (age 5-64 years*)
11 per 10,000 (age ≥65 years*)

*Age adjusted to the 2000 U.S. standard population.

Figure 19. Rates (per 10,000) [1,2] of Hospitalization due to Asthma [3] for Children (aged less than 18 years) in Mid-Michigan [4] and the State of Michigan, 2000-2002, Compared to the Healthy People 2010 Target (Objective 1-9a).



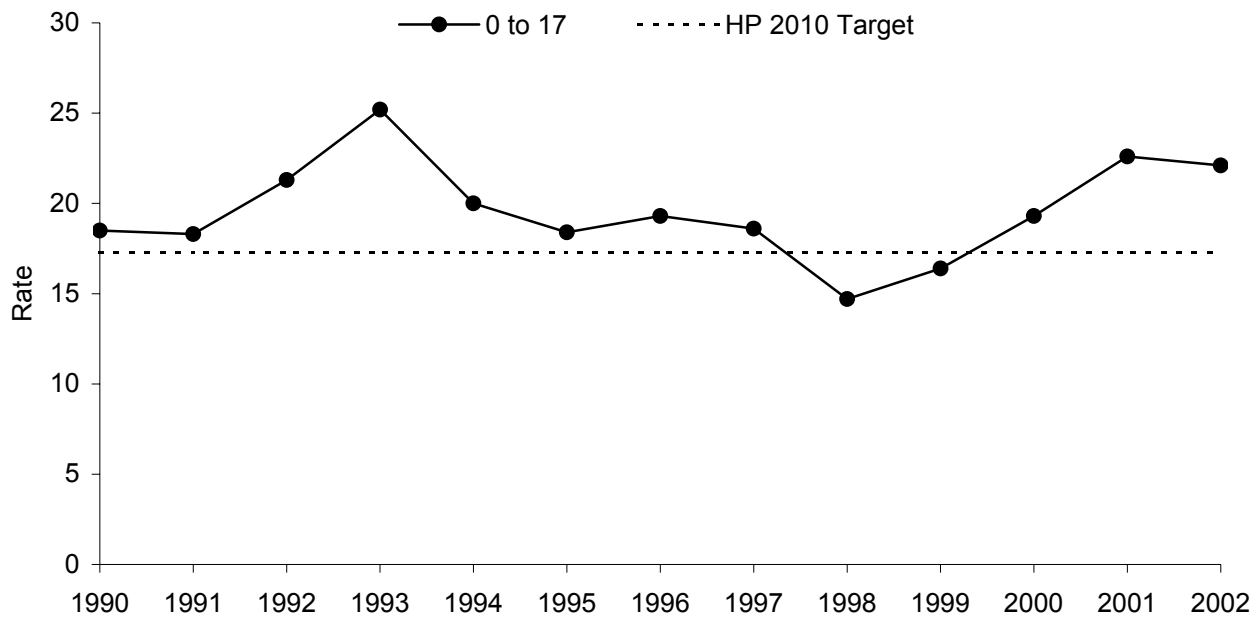
- 1 Population estimates are taken from the Michigan population estimates for 2001.
- 2 Not age adjusted in accordance with analysis prescribed by Healthy People 2010 Objectives.
- 3 Asthma hospitalization is defined as a primary discharge diagnosis of asthma, ICD-9-CM=493.XX.
- 4 Mid-Michigan is defined by the Mid-Michigan Asthma Coalition coverage area (Clinton, Eaton, Ingham Counties).

	Total Population
Mid-Michigan Rate	21.3
95% CI	19.7 , 22.9
Count	704
Michigan Rate	23.5
95% CI	23.2 , 23.8
Count	18,141
HP 2010 Target	17.3

Data Source: Michigan Inpatient Database, Bureau of Epidemiology, MDCH.

- ✧ The average number of hospitalizations due to asthma per year for children aged less than 18 years in Mid-Michigan, 2000-2002, is 235.
- ✧ The rate of asthma hospitalization for children aged less than 18 years in Mid-Michigan, 2000-2002, is significantly higher than the *Healthy People 2010* objective.

Figure 20. Annual Rates (per 10,000) [1,2] of Asthma [3] Hospitalization for Children (aged less than 18 years) in Mid-Michigan [4], 1990-2002, Compared to the Healthy People 2010 Target (Objective 1-9a).



- 1 Population estimates are taken from the Michigan population estimates for 1990-2002.
- 2 Not age adjusted in accordance with analysis prescribed by Healthy People 2010 Objectives.
- 3 Asthma hospitalization is defined as a primary discharge diagnosis of asthma, ICD-9-CM=493.XX.
- 4 Mid-Michigan is defined by the Mid-Michigan Asthma Coalition coverage area (Clinton, Eaton, Ingham Counties).

Year	0 to 17	
	Rate	Count
1990	18.5	205
1991	18.3	204
1992	21.3	239
1993	25.2	284
1994	20.0	226
1995	18.4	208
1996	19.3	218
1997	18.6	209
1998	14.7	164
1999	16.4	182
2000	19.3	213
2001	22.6	249
2002	22.1	242

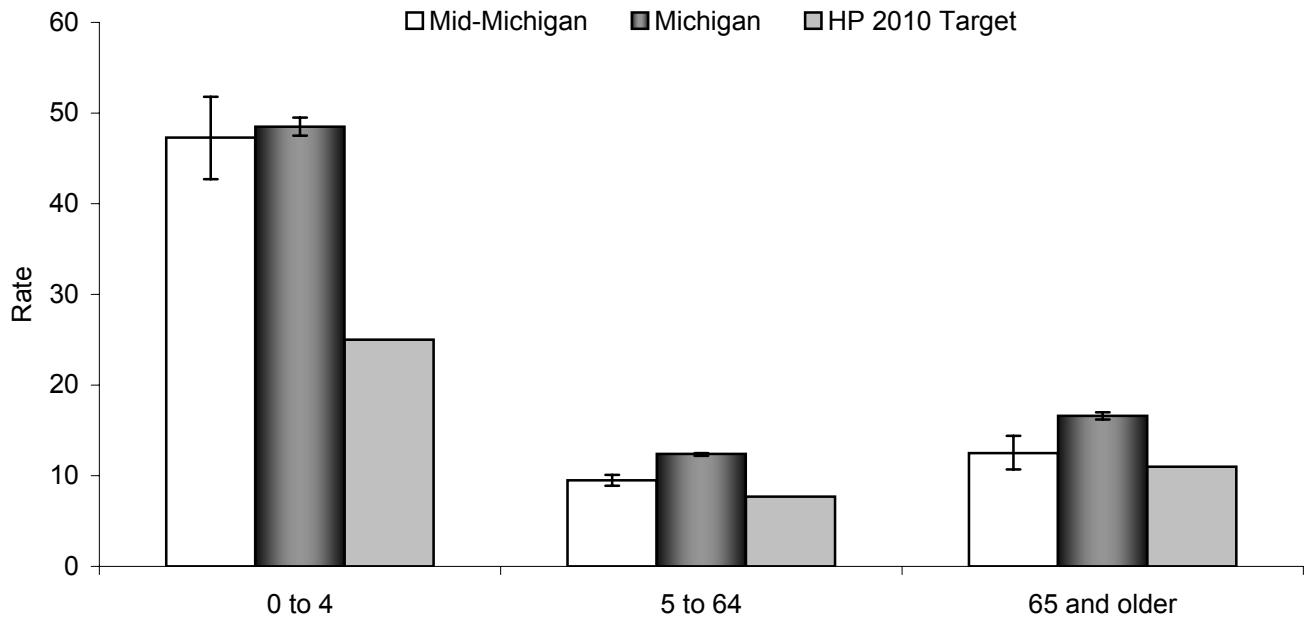
HP 2010 Target	17.3
-----------------------	-------------

Data Source: Michigan Inpatient Database, Bureau of Epidemiology, MDCH.

✧ Between 1990 and 2002, there has not been a significant change in asthma hospitalization rates among persons aged less than 18 years in Mid-Michigan ($p = 0.13$, $p = 0.667$).

See appendix page 56 for supporting data.

Figure 21. Rates (per 10,000) [1,2] of Hospitalization due to Asthma [3] by Age Group for Mid-Michigan [4] and the State of Michigan, 2000-2002, Compared to the Healthy People 2010 Targets (Objective 24-2).



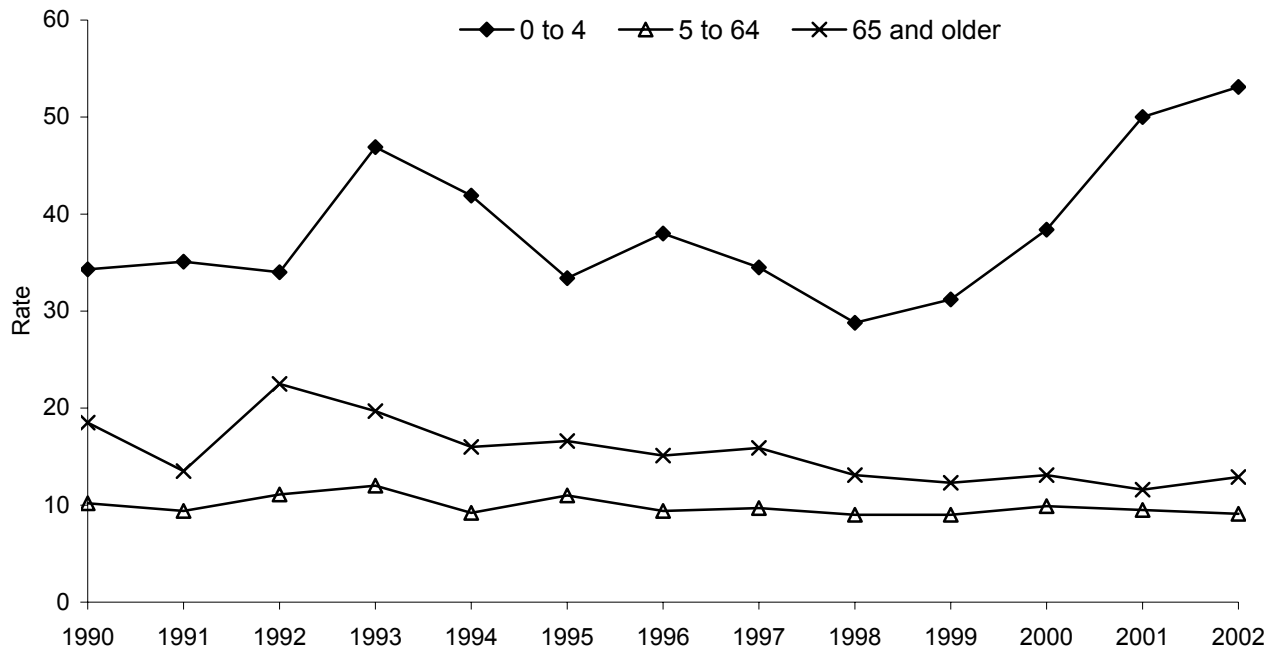
- 1 For age group 5-64 years and age group 65 and older, rates are age adjusted to the 2000 US standard population by the direct standardization method. Hospitalization records with missing age are excluded.
- 2 Population estimates are taken from the Michigan population estimates for 2001.
- 3 Asthma hospitalization is defined as a primary discharge diagnosis of asthma, ICD-9-CM=493.XX.
- 4 Mid-Michigan is defined by the Mid-Michigan Asthma Coalition coverage area (Clinton, Eaton, Ingham Counties).

	0 to 4	5 to 64	65 and Older
Mid-Michigan Rate	47.3	9.5	12.5
95% CI	42.7 , 51.8	8.9 , 10.1	10.7 , 14.4
Count	408	1,043	172
Michigan Rate	48.5	12.4	16.6
95% CI	47.5 , 49.5	12.2 , 12.5	16.2 , 17.0
Count	9,637	30,198	6,110
HP 2010 Target	25.0	7.7	11.0

Data Source: Michigan Inpatient Database, Bureau of Epidemiology, MDCH.

- ✧ The rate of asthma hospitalization in Mid-Michigan is significantly higher than the *Healthy People 2010* Target Rate for the 0 to 4 and 5 to 64 year age groups, 2000-2002.
- ✧ The rate of asthma hospitalization in Mid-Michigan is significantly lower than the rate for Michigan as a whole for the 5 to 64 year and 65 and older age groups, 2000-2002.

Figure 22. Annual Rates (per 10,000) [1,2] of Asthma [3] Hospitalization by Age Group for Mid Michigan [4], 1990-2002, Compared to the Healthy People 2010 Targets (Objective 24-2).



- 1 For age group 5-64 years and age group 65 and older, rates are age adjusted to the 2000 US standard population by the direct standardization method. Hospitalization records with missing age are excluded.
- 2 Population estimates are taken from the Michigan population estimates for 1990-2002.
- 3 Asthma hospitalization is defined as a primary discharge diagnosis of asthma, ICD-9-CM=493.XX.
- 4 Mid-Michigan is defined by the Mid-Michigan Asthma Coalition coverage area (Clinton, Eaton, Ingham Counties).

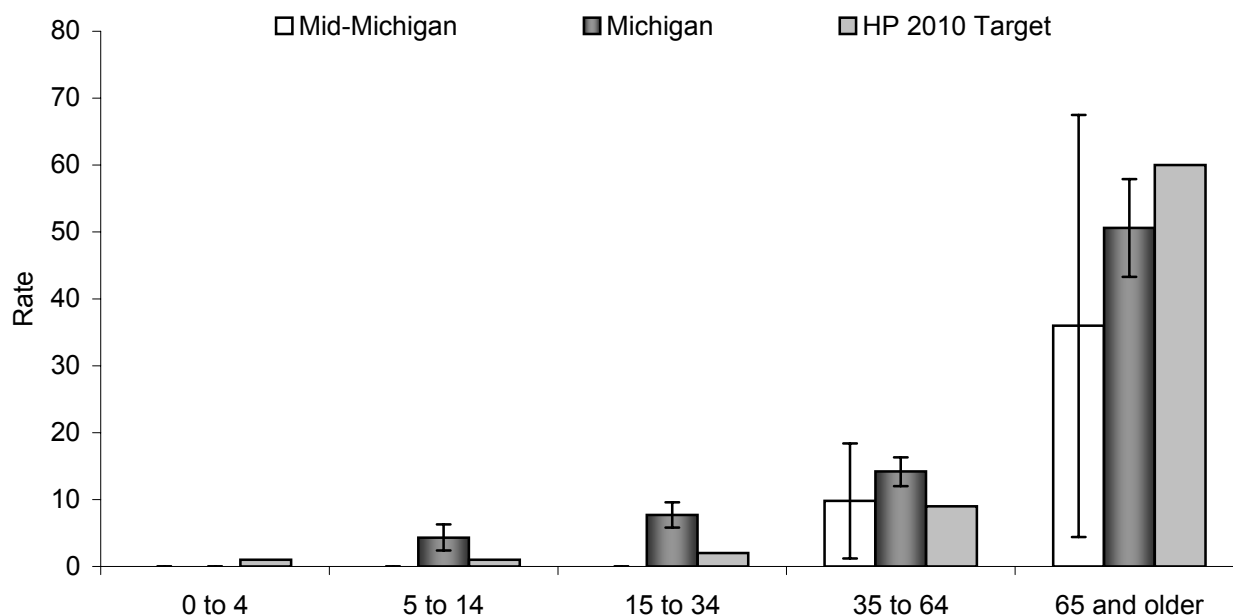
Year	0 to 4		5 to 64		65 and Older	
	Rate	Count	Rate	Count	Rate	Count
1990	34.3	110	10.2	331	18.5	72
1991	35.1	113	9.4	315	13.5	53
1992	34.0	109	11.1	380	22.5	91
1993	46.9	149	12.0	424	19.7	80
1994	41.9	131	9.2	329	16.0	69
1995	33.4	102	11.0	395	16.6	72
1996	38.0	114	9.4	339	15.1	66
1997	34.5	102	9.7	355	15.9	70
1998	28.8	84	9.0	326	13.1	58
1999	31.2	90	9.0	328	12.3	55
2000	38.4	111	9.9	361	13.1	59
2001	50.0	144	9.5	347	11.6	53
2002	53.1	153	9.1	335	12.9	60
HP 2010 Target	25.0		7.7		11.0	

Data Source: Michigan Inpatient Database, Bureau of Epidemiology, MDCH.

✧ Between 1990 and 2002, there has been a significant decrease in asthma hospitalization rates for persons aged 65 years and older in Mid-Michigan (65 and older, $\rho = -0.81$, $p < 0.01$).

See appendix pages 57 through 59 for supporting data.

Figure 23. Rates (per 1,000,000) [1] of Mortality due to Asthma [2] by Age Group for Mid-Michigan [3] and the State of Michigan, 2001-2003, Compared to the Healthy People 2010 Targets (Objective 24-1).



1 Population estimates are taken from the Michigan population estimates for 2002.

2 Asthma death is defined as a primary cause of death as asthma, ICD-10=J45 or J46.

3 Mid-Michigan is defined by the Mid-Michigan Asthma Coalition coverage area (Clinton, Eaton, Ingham Counties).

	0 to 4	5 to 14	15 to 34	35 to 64	65 and Older
Mid-Michigan Rate	‡	‡	‡	9.8	36.0
95% CI	‡, ‡	‡, ‡	‡, ‡	1.2, 18.4	4.4, 67.5
Count	~	~	~	5	5
Michigan Rate	‡	4.3	7.7	14.2	50.6
95% CI	‡, ‡	2.4, 6.3	5.8, 9.6	12.0, 16.3	43.3, 57.9
Count	~	19	63	168	187
HP 2010 Target	1.0	1.0	2.0	9.0	60.0

‡ Insufficient data to compute a stable rate (number of events <5 or population <5000).

~ Due to a low number of events (<5), results are suppressed to protect the identity of the deceased.

Data Source: Michigan Resident Death Files, Bureau of Epidemiology, MDCH.

- ✧ The rate of asthma mortality in the State of Michigan is significantly higher than the *Healthy People 2010* Target Rate for the 5 to 14, 15 to 34, and 35 to 64 year age groups, 2001-2003.
- ✧ The rate of asthma mortality in the State of Michigan is significantly lower than the *Healthy People 2010* Target Rate for the 65 years and older age group, 2001-2003.

Section 5: Appendix

This appendix includes a compilation of supporting data tables presenting annual hospitalization and mortality rates for Clinton, Eaton, and Ingham Counties, Mid-Michigan, and the State of Michigan. It also includes a summary for each Mid-Michigan county of 3-year hospitalization rates by age, race, and sex strata.

Counts and Rates (per 10,000) [1,2] of Asthma [3] Hospitalization [4] by Year, All Ages, for Clinton, Eaton, and Ingham Counties, Mid-Michigan [5], and the State of Michigan, 1990-2002.

Year	Clinton		Eaton		Ingham		Mid-Michigan		Michigan	
	Rate	Count	Rate	Count	Rate	Count	Rate	Count	Rate	Count
1990	14.9	81	10.0	91	13.6	341	12.9	513	19.1	17,790
1991	11.7	66	10.1	94	12.4	321	11.7	481	18.1	16,995
1992	14.7	85	11.8	110	15.0	385	14.1	580	18.4	17,597
1993	14.7	89	13.6	129	16.2	435	15.4	653	19.8	18,975
1994	11.7	68	10.6	102	13.1	359	12.3	529	18.4	17,609
1995	10.4	62	12.2	120	14.3	387	13.2	569	19.5	18,945
1996	11.7	72	9.4	93	13.1	354	12.1	519	18.5	18,058
1997	11.7	72	11.3	112	12.8	343	12.2	527	17.7	17,320
1998	11.2	72	8.6	87	11.7	309	10.9	468	15.6	15,289
1999	10.7	67	9.2	95	12.1	311	11.0	473	15.6	15,385
2000	7.6	49	10.1	102	14.4	380	12.3	531	16.0	15,886
2001	10.4	66	9.9	100	14.2	378	12.6	544	15.5	15,363
2002	9.3	59	11.8	120	13.8	369	12.7	548	14.7	14,696

Spearman's ρ	-0.85**	-0.25	-0.09	-0.29	-0.79**
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1 Population estimates are taken from the Michigan population estimates for 1990-2002.

2 Rates are age adjusted to the 2000 US standard population by the direct standardization method. Hospitalization records with missing age are excluded.

3 Asthma hospitalization is defined as a primary discharge diagnosis of asthma, ICD-9-CM=493.XX.

4 Data Source: Michigan Inpatient Database, Bureau of Epidemiology, MDCH.

5 Mid-Michigan is defined by the Mid-Michigan Asthma Coalition coverage area (Clinton, Eaton, Ingham Counties).

** Correlation is statistically significant; p-value < 0.01.

Sample Interpretation of Annual Rate:

In 2002, the rate of asthma hospitalization in Michigan was 14.7 per 10,000 population.

Sample Trend Interpretation:

Between 1990 and 2002, there has been a significant overall decrease in asthma hospitalization rates in Michigan.

Counts and Rates (per 10,000) [1,2] of Asthma [3] Hospitalization [4] by Year for MALES All Ages, for Clinton, Eaton, and Ingham Counties, Mid-Michigan [5], and the State of Michigan, 1990-2002.

Year	Clinton		Eaton		Ingham		Mid-Michigan		Michigan	
	Rate	Count	Rate	Count	Rate	Count	Rate	Count	Rate	Count
1990	8.3	23	8.4	36	10.5	141	9.8	200	17.1	7,951
1991	11.3	28	8.0	37	10.1	125	9.7	190	15.7	7,345
1992	10.8	31	13.0	58	13.1	164	12.7	253	16.1	7,666
1993	9.6	30	12.7	60	11.7	160	11.7	250	16.6	7,929
1994	10.0	30	9.7	47	12.3	165	11.4	242	15.4	7,339
1995	8.6	24	10.0	50	12.4	161	11.2	235	17.1	8,275
1996	12.3	36	8.6	43	10.8	140	10.5	219	15.9	7,725
1997	12.1	34	9.8	48	10.2	135	10.3	217	15.4	7,546
1998	9.0	26	6.9	34	8.6	112	8.2	172	12.7	6,199
1999	8.1	26	8.2	41	11.2	141	9.7	208	12.7	6,229
2000	8.3	25	8.2	40	11.9	156	10.5	221	13.7	6,745
2001	9.6	30	9.5	46	11.3	153	10.6	229	12.8	6,271
2002	7.4	21	11.5	54	12.5	168	11.4	243	12.2	5,971

Spearman's ρ	-0.41	-0.10	0.14	-0.06	-0.82**
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1 Population estimates are taken from the Michigan population estimates for 1990-2002.

2 Rates are age adjusted to the 2000 US standard population by the direct standardization method. Hospitalization records with missing age are excluded.

3 Asthma hospitalization is defined as a primary discharge diagnosis of asthma, ICD-9-CM=493.XX.

4 Data Source: Michigan Inpatient Database, Bureau of Epidemiology, MDCH.

5 Mid-Michigan is defined by the Mid-Michigan Asthma Coalition coverage area (Clinton, Eaton, Ingham Counties).

** Correlation is statistically significant; p-value < 0.01.

Sample Interpretation of Annual Rate:

In 2002, the rate of asthma hospitalization among males in Michigan was 12.2 per 10,000 population.

Sample Trend Interpretation:

Between 1990 and 2002, there has been a significant overall decrease in asthma hospitalization rates for males in Michigan.

Counts and Rates (per 10,000) [1,2] of Asthma [3] Hospitalization [4] by Year for FEMALES, All Ages, for Clinton, Eaton, and Ingham Counties, Mid-Michigan [5], and the State of Michigan, 1990-2002.

Year	Clinton		Eaton		Ingham		Mid-Michigan		Michigan	
	Rate	Count	Rate	Count	Rate	Count	Rate	Count	Rate	Count
1990	20.7	58	11.7	55	15.8	200	15.4	313	20.6	9,834
1991	12.7	38	12.0	57	14.6	196	13.6	291	20.0	9,648
1992	18.1	54	10.7	52	16.6	221	15.2	327	20.3	9,927
1993	19.3	59	14.1	69	19.7	275	18.4	403	22.6	11,043
1994	12.6	38	11.2	55	13.7	194	13.0	287	20.9	10,269
1995	12.1	38	13.8	70	16.0	226	15.0	334	21.6	10,668
1996	11.3	36	9.7	50	15.3	214	13.5	300	20.8	10,333
1997	11.8	38	12.6	64	15.0	208	14.0	310	19.6	9,774
1998	14.0	46	10.2	53	14.3	197	13.3	296	18.1	9,089
1999	13.0	41	10.0	54	12.5	170	11.9	265	18.1	9,155
2000	7.5	24	11.3	62	16.5	224	13.9	310	18.0	9,141
2001	11.2	36	10.1	54	16.5	225	14.1	315	17.8	9,092
2002	11.3	38	12.2	66	14.8	201	13.6	305	16.9	8,725

Spearman's ρ	-0.72**	-0.26	-0.16	-0.40	-0.76**
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1 Population estimates are taken from the Michigan population estimates for 1990-2002.

2 Rates are age adjusted to the 2000 US standard population by the direct standardization method. Hospitalization records with missing age are excluded.

3 Asthma hospitalization is defined as a primary discharge diagnosis of asthma, ICD-9-CM=493.XX.

4 Data Source: Michigan Inpatient Database, Bureau of Epidemiology, MDCH.

5 Mid-Michigan is defined by the Mid-Michigan Asthma Coalition coverage area (Clinton, Eaton, Ingham Counties).

** Correlation is statistically significant; p-value < 0.01.

Sample Interpretation of Annual Rate:

In 2002, the rate of asthma hospitalization among females in Michigan was 16.9 per 10,000 population.

Sample Trend Interpretation:

Between 1990 and 2002, there has been a significant overall decrease in asthma hospitalization rates for females in Michigan.

Counts and Rates (per 10,000) [1,2] of Asthma [3] Hospitalization [4] by Year for WHITES [5], All Ages, for Clinton, Eaton, and Ingham Counties, Mid-Michigan [6], and the State of Michigan, 1990-2002.

Year	Clinton		Eaton		Ingham		Mid-Michigan		Michigan	
	Rate	Count	Rate	Count	Rate	Count	Rate	Count	Rate	Count
1990	14.7	79	10.0	87	11.8	255	11.8	421	15.1	11,791
1991	10.8	60	9.4	83	11.3	251	10.7	394	14.2	11,148
1992	14.2	81	11.9	105	13.8	305	13.3	491	14.1	11,165
1993	13.5	80	12.9	116	13.9	315	13.6	511	14.8	11,757
1994	11.1	64	9.9	89	10.7	246	10.6	399	13.2	10,488
1995	9.9	58	11.9	110	12.0	272	11.5	440	13.2	10,586
1996	11.6	70	9.5	87	10.6	239	10.5	396	12.6	10,140
1997	11.2	68	11.3	104	11.3	251	11.2	423	12.2	9,849
1998	11.1	70	8.9	83	10.0	223	9.9	376	10.5	8,522
1999	10.6	65	9.0	85	9.9	212	9.5	362	10.7	8,716
2000	6.7	42	9.7	91	11.7	249	10.3	382	10.8	8,781
2001	9.4	58	8.4	79	11.6	246	10.4	383	10.5	8,541
2002	8.4	53	10.1	94	10.9	236	10.3	383	9.9	8,133

Spearman's ρ	-0.76**	-0.40	-0.43	-0.78**	-0.95**
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1 Population estimates are taken from the Michigan population estimates for 1990-2002.

2 Rates are age adjusted to the 2000 US standard population by the direct standardization method. Hospitalization records with missing age are excluded.

3 Asthma hospitalization is defined as a primary discharge diagnosis of asthma, ICD-9-CM=493.XX.

4 Data Source: Michigan Inpatient Database, Bureau of Epidemiology, MDCH.

5 For records that are missing data for race, race was assigned based on the 1990 census population for Michigan.

6 Mid-Michigan is defined by the Mid-Michigan Asthma Coalition coverage area (Clinton, Eaton, Ingham Counties).

** Correlation is statistically significant; p-value < 0.01.

Sample Interpretation of Annual Rate:

In 2002, the rate of asthma hospitalization among whites in Michigan was 9.9 per 10,000 population.

Sample Trend Interpretation:

Between 1990 and 2002, there has been a significant overall decrease in asthma hospitalization rates for whites in Michigan.

Counts and Rates (per 10,000) [1,2] of Asthma [3] Hospitalization [4] by Year for BLACKS [5], All Ages, for Clinton, Eaton, and Ingham Counties, Mid-Michigan [6], and the State of Michigan, 1990-2002.

Year	Clinton		Eaton		Ingham		Mid-Michigan		Michigan	
	Rate	Count	Rate	Count	Rate	Count	Rate	Count	Rate	Count
1990	‡	~	‡	~	26.6	72	25.1	75	43.0	5,800
1991	‡	~	‡	~	23.3	64	23.7	76	41.4	5,715
1992	‡	~	‡	~	27.9	75	26.4	82	44.4	6,209
1993	‡	~	‡	~	35.4	104	35.9	118	49.1	6,948
1994	‡	~	‡	~	28.1	89	27.5	100	48.5	6,858
1995	‡	~	‡	~	32.2	97	33.1	110	54.0	8,031
1996	‡	~	‡	~	37.4	102	33.7	107	51.3	7,603
1997	‡	~	‡	~	28.5	88	26.8	96	48.0	7,246
1998	‡	~	‡	~	26.7	81	23.8	87	45.3	6,607
1999	‡	~	‡	~	29.2	87	26.7	97	44.2	6,459
2000	‡	6	‡	10	34.7	118	32.3	134	45.2	6,888
2001	‡	6	‡	18	32.0	121	31.6	145	43.2	6,518
2002	‡	6	32.1	24	33.7	117	33.8	147	42.0	6,279

Spearman's ρ	ψ	ψ	0.49	0.39	-0.07
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1 Population estimates are taken from the Michigan population estimates for 1990-2002.

2 Rates are age adjusted to the 2000 US standard population by the direct standardization method. Hospitalization records with missing age are excluded.

3 Asthma hospitalization is defined as a primary discharge diagnosis of asthma, ICD-9-CM=493.XX.

4 Data Source: Michigan Inpatient Database, Bureau of Epidemiology, MDCH.

5 For records that are missing data for race, race was assigned based on the 1990 census population for Michigan.

6 Mid-Michigan is defined by the Mid-Michigan Asthma Coalition coverage area (Clinton, Eaton, Ingham Counties).

‡ Insufficient data to compute a stable rate (number of events ≤ 20 or population < 5000).

~ Due to a low number of events, data are suppressed.

ψ Insufficient data to compute Spearman Correlation Coefficient.

Sample Interpretation of Annual Rate:

In 2002, the rate of asthma hospitalization among blacks in Michigan was 42.0 per 10,000 population.

Sample Trend Interpretation:

Between 1990 and 2002, a significant overall trend in asthma hospitalization rates has not been observed for blacks in Michigan.

Counts and Rates (per 10,000) [1,2] of Asthma [3] Hospitalization [4] by Year for WHITE MALES [5], All Ages, for Clinton, Eaton, and Ingham Counties, Mid-Michigan [6], and the State of Michigan, 1990-2002.

Year	Clinton		Eaton		Ingham		Mid-Michigan		Michigan	
	Rate	Count	Rate	Count	Rate	Count	Rate	Count	Rate	Count
1990	8.4	23	8.4	34	8.7	95	8.6	152	13.4	5,142
1991	10.5	25	7.2	31	9.0	95	8.7	151	12.0	4,632
1992	10.4	29	13.0	55	11.9	124	11.9	208	12.1	4,715
1993	7.3	22	12.0	53	9.6	104	9.8	179	11.9	4,633
1994	9.8	29	8.2	37	8.9	99	8.9	165	10.4	4,033
1995	8.4	23	10.2	47	9.5	98	9.3	168	10.9	4,285
1996	12.4	36	8.5	39	9.0	93	9.4	168	10.2	4,012
1997	11.4	31	9.8	44	8.5	92	9.2	167	10.1	3,993
1998	9.2	26	7.1	32	6.9	72	7.3	130	8.1	3,198
1999	8.0	25	7.6	34	9.2	93	8.2	152	8.5	3,338
2000	7.6	22	7.7	34	9.4	95	8.6	151	8.9	3,499
2001	8.6	26	7.7	34	9.7	99	9.0	159	8.4	3,284
2002	‡	18	10.0	42	9.3	98	9.0	158	8.0	3,133

Spearman's ρ	ψ	-0.23	0.11	-0.23	-0.95**
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1 Population estimates are taken from the Michigan population estimates for 1990-2002.

2 Rates are age adjusted to the 2000 US standard population by the direct standardization method. Hospitalization records with missing age are excluded.

3 Asthma hospitalization is defined as a primary discharge diagnosis of asthma, ICD-9-CM=493.XX.

4 Data Source: Michigan Inpatient Database, Bureau of Epidemiology, MDCH.

5 For records that are missing data for race, race was assigned based on the 1990 census population for Michigan.

6 Mid-Michigan is defined by the Mid-Michigan Asthma Coalition coverage area (Clinton, Eaton, Ingham Counties).

‡ Insufficient data to compute a stable rate (number of events ≤ 20 or population < 5000).

~ Due to a low number of events, data are suppressed.

** Correlation is statistically significant; p-value < 0.01 .

ψ Insufficient data to compute Spearman Correlation Coefficient.

Sample Interpretation of Annual Rate:

In 2002, the rate of asthma hospitalization among white males in Michigan was 8.0 per 10,000 population.

Sample Trend Interpretation:

Between 1990 and 2002, there has been a significant overall decrease in asthma hospitalization rates for white males in Michigan.

**Counts and Rates (per 10,000) [1,2] of Asthma [3] Hospitalization [4] by Year for
WHITE FEMALES [5], All Ages, for Clinton, Eaton, and Ingham Counties, Mid-
Michigan [6], and the State of Michigan, 1990-2002.**

Year	Clinton		Eaton		Ingham		Mid-Michigan		Michigan	
	Rate	Count	Rate	Count	Rate	Count	Rate	Count	Rate	Count
1990	20.2	56	11.7	53	14.1	160	14.3	269	16.5	6,647
1991	11.9	35	11.5	52	13.4	156	12.6	243	16.0	6,514
1992	17.6	52	10.8	50	15.4	181	14.5	283	15.7	6,446
1993	19.2	58	13.6	63	17.5	211	16.8	332	17.3	7,122
1994	11.7	35	11.1	52	12.2	147	11.8	234	15.6	6,455
1995	11.3	35	13.1	63	14.4	174	13.6	272	15.2	6,301
1996	10.8	34	9.9	48	12.3	146	11.5	228	14.8	6,128
1997	11.7	37	12.6	60	13.6	159	13.0	256	14.1	5,856
1998	13.7	44	10.5	51	12.7	151	12.4	246	12.7	5,324
1999	12.9	40	10.1	51	10.2	119	10.5	210	12.7	5,378
2000	‡	20	11.1	57	13.7	154	11.8	231	12.5	5,282
2001	10.2	32	9.0	45	13.1	147	11.5	224	12.4	5,257
2002	10.5	35	10.2	52	12.1	138	11.4	225	11.6	5,000

Spearman's ρ	ψ	-0.58*	-0.55	-0.75**	-0.97**
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1 Population estimates are taken from the Michigan population estimates for 1990-2002.

2 Rates are age adjusted to the 2000 US standard population by the direct standardization method. Hospitalization records with missing age are excluded.

3 Asthma hospitalization is defined as a primary discharge diagnosis of asthma, ICD-9-CM=493.XX.

4 Data Source: Michigan Inpatient Database, Bureau of Epidemiology, MDCH.

5 For records that are missing data for race, race was assigned based on the 1990 census population for Michigan.

6 Mid-Michigan is defined by the Mid-Michigan Asthma Coalition coverage area (Clinton, Eaton, Ingham Counties).

‡ Insufficient data to compute a stable rate (number of events ≤ 20 or population < 5000).

~ Due to a low number of events, data are suppressed.

* Correlation is statistically significant; p-value < 0.05 .

** Correlation is statistically significant; p-value < 0.01 .

ψ Insufficient data to compute Spearman Correlation Coefficient.

Sample Interpretation of Annual Rate:

In 2002, the rate of asthma hospitalization among white females in Michigan was 11.6 per 10,000 population.

Sample Trend Interpretation:

Between 1990 and 2002, there has been a significant overall decrease in asthma hospitalization rates for white females in Michigan.

Counts and Rates (per 10,000) [1,2] of Asthma [3] Hospitalization [4] by Year for BLACK MALES [5], All Ages, for Clinton, Eaton, and Ingham Counties, Mid-Michigan [6], and the State of Michigan, 1990-2002.

Year	Clinton		Eaton		Ingham		Mid-Michigan		Michigan	
	Rate	Count	Rate	Count	Rate	Count	Rate	Count	Rate	Count
1990	‡	~	‡	~	21.6	41	20.0	43	39.2	2,721
1991	‡	~	‡	~	22.5	30	21.9	36	36.6	2,660
1992	‡	~	‡	~	22.2	39	21.2	43	39.0	2,864
1993	‡	~	‡	~	28.9	50	30.5	59	42.8	3,169
1994	‡	~	‡	~	34.6	52	32.7	58	43.1	3,176
1995	‡	~	‡	~	29.8	54	27.5	58	48.6	3,838
1996	‡	~	‡	~	24.1	40	21.9	42	45.8	3,569
1997	‡	~	‡	~	25.7	41	25.6	47	43.7	3,452
1998	‡	~	‡	~	17.9	36	15.9	38	38.3	2,927
1999	‡	~	‡	~	21.6	39	21.7	46	37.0	2,796
2000	‡	~	‡	~	26.5	52	24.9	60	39.4	3,147
2001	‡	~	‡	~	23.6	49	24.7	62	36.6	2,856
2002	‡	~	‡	~	31.7	59	31.1	72	35.0	2,699

Spearman's ρ	ψ	ψ	0.18	0.23	-0.30
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1 Population estimates are taken from the Michigan population estimates for 1990-2002.

2 Rates are age adjusted to the 2000 US standard population by the direct standardization method. Hospitalization records with missing age are excluded.

3 Asthma hospitalization is defined as a primary discharge diagnosis of asthma, ICD-9-CM=493.XX.

4 Data Source: Michigan Inpatient Database, Bureau of Epidemiology, MDCH.

5 For records that are missing data for race, race was assigned based on the 1990 census population for Michigan.

6 Mid-Michigan is defined by the Mid-Michigan Asthma Coalition coverage area (Clinton, Eaton, Ingham Counties).

‡ Insufficient data to compute a stable rate (number of events ≤ 20 or population < 5000).

~ Due to a low number of events, data are suppressed.

ψ Insufficient data to compute Spearman Correlation Coefficient.

Sample Interpretation of Annual Rate:

In 2002, the rate of asthma hospitalization among black males in Michigan was 35.0 per 10,000 population.

Sample Trend Interpretation:

Between 1990 and 2002, a significant overall trend in asthma hospitalization rates has not been observed for black males in Michigan.

Counts and Rates (per 10,000) [1,2] of Asthma [3] Hospitalization [4] by Year for BLACK FEMALES [5], All Ages, for Clinton, Eaton, and Ingham Counties, Mid-Michigan [6], and the State of Michigan, 1990-2002.

Year	Clinton		Eaton		Ingham		Mid-Michigan		Michigan	
	Rate	Count	Rate	Count	Rate	Count	Rate	Count	Rate	Count
1990	‡	~	‡	~	29.7	31	28.3	32	45.3	3,079
1991	‡	~	‡	~	23.5	34	24.6	40	44.3	3,055
1992	‡	~	‡	~	31.1	36	29.2	39	47.8	3,345
1993	‡	~	‡	~	39.8	54	38.9	59	53.4	3,779
1994	‡	~	‡	~	22.5	37	23.1	42	51.9	3,682
1995	‡	~	‡	~	32.4	43	35.6	52	57.1	4,193
1996	‡	~	‡	~	47.3	62	42.5	65	54.7	4,034
1997	‡	~	‡	~	31.2	47	28.1	49	50.6	3,794
1998	‡	~	‡	~	33.3	45	29.7	49	50.0	3,680
1999	‡	~	‡	~	35.3	48	30.9	51	49.4	3,663
2000	‡	~	‡	~	41.2	66	38.2	74	49.0	3,741
2001	‡	~	‡	~	40.3	72	38.0	83	48.0	3,662
2002	‡	~	‡	~	35.3	58	36.1	75	47.0	3,580

Spearman's ρ	ψ	ψ	0.64*	0.46	0.08
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1 Population estimates are taken from the Michigan population estimates for 1990-2002.

2 Rates are age adjusted to the 2000 US standard population by the direct standardization method. Hospitalization records with missing age are excluded.

3 Asthma hospitalization is defined as a primary discharge diagnosis of asthma, ICD-9-CM=493.XX.

4 Data Source: Michigan Inpatient Database, Bureau of Epidemiology, MDCH.

5 For records that are missing data for race, race was assigned based on the 1990 census population for Michigan.

6 Mid-Michigan is defined by the Mid-Michigan Asthma Coalition coverage area (Clinton, Eaton, Ingham Counties).

‡ Insufficient data to compute a stable rate (number of events ≤ 20 or population < 5000).

~ Due to a low number of events, data are suppressed.

* Correlation is statistically significant; p-value < 0.05 .

ψ Insufficient data to compute Spearman Correlation Coefficient.

Sample Interpretation of Annual Rate:

In 2002, the rate of asthma hospitalization among black females in Michigan was 47.0 per 10,000 population.

Sample Trend Interpretation:

Between 1990 and 2002, a significant overall trend in asthma hospitalization rates has not been observed for black females in Michigan.

Counts and Rates (per 10,000) [1,2] of Asthma [3] Hospitalization [4] by Year for CHILDREN Aged 0 to 4 Years, for Clinton, Eaton, and Ingham Counties, Mid-Michigan [5], and the State of Michigan, 1990-2002.

Year	Clinton		Eaton		Ingham		Mid-Michigan		Michigan	
	Rate	Count	Rate	Count	Rate	Count	Rate	Count	Rate	Count
1990	‡	11	‡	16	39.6	83	34.3	110	66.1	4,712
1991	‡	15	47.4	32	31.5	66	35.1	113	57.1	4,106
1992	‡	22	34.0	23	30.7	64	34.0	109	64.4	4,638
1993	‡	17	35.5	24	52.5	108	46.9	149	59.6	4,291
1994	‡	11	‡	19	50.2	101	41.9	131	53.2	3,783
1995	‡	11	‡	20	36.5	71	33.4	102	63.9	4,457
1996	‡	15	31.7	21	41.0	78	38.0	114	59.6	4,092
1997	‡	~	50.1	~	34.9	65	34.5	102	59.2	4,019
1998	‡	8	‡	17	32.4	59	28.8	84	40.5	2,734
1999	‡	11	‡	17	34.7	62	31.2	90	40.6	2,725
2000	‡	10	38.0	25	42.5	76	38.4	111	48.8	3,257
2001	‡	21	48.2	31	50.7	92	50.0	144	50.5	3,341
2002	‡	15	54.5	35	56.2	103	53.1	153	45.8	3,039

Spearman's ρ	ψ	ψ	0.41	0.28	-0.76**
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1 Population estimates are taken from the Michigan population estimates for 1990-2002.

2 Rates are not age adjusted. Hospitalization records with missing age are excluded.

3 Asthma hospitalization is defined as a primary discharge diagnosis of asthma, ICD-9-CM=493.XX.

4 Data Source: Michigan Inpatient Database, Bureau of Epidemiology, MDCH.

5 Mid-Michigan is defined by the Mid-Michigan Asthma Coalition coverage area (Clinton, Eaton, Ingham Counties).

‡ Insufficient data to compute a stable rate (number of events ≤ 20 or population < 5000).

~ Due to a low number of events, data are suppressed.

** Correlation is statistically significant; p-value < 0.01 .

ψ Insufficient data to compute Spearman Correlation Coefficient.

Sample Interpretation of Annual Rate:

In 2002, the rate of asthma hospitalization among children 0 to 4 years in Michigan was 45.8 per 10,000 population.

Sample Trend Interpretation:

Between 1990 and 2002, there has been a significant overall decrease in asthma hospitalization rates for children 0 to 4 years in Michigan.

Counts and Rates (per 10,000) [1,2] of Asthma [3] Hospitalization [4] by Year for CHILDREN Aged 5 to 14 Years, for Clinton, Eaton, and Ingham Counties, Mid-Michigan [5], and the State of Michigan, 1990-2002.

Year	Clinton		Eaton		Ingham		Mid-Michigan		Michigan	
	Rate	Count	Rate	Count	Rate	Count	Rate	Count	Rate	Count
1990	‡	13	‡	11	16.9	63	14.2	87	20.9	2,826
1991	‡	10	‡	11	15.7	59	12.8	80	19.4	2,666
1992	‡	9	17.3	26	19.6	74	17.4	109	18.5	2,571
1993	‡	18	23.2	35	17.2	65	18.8	118	21.1	2,972
1994	‡	8	‡	16	14.3	54	12.4	78	17.1	2,418
1995	‡	7	‡	18	15.7	59	13.3	84	21.9	3,152
1996	‡	12	14.9	23	12.7	48	13.1	83	21.4	3,113
1997	‡	15	‡	13	14.1	53	12.8	81	22.1	3,244
1998	‡	18	‡	9	10.2	38	10.3	65	16.8	2,491
1999	‡	7	‡	14	16.2	60	12.9	81	16.8	2,497
2000	‡	10	‡	10	18.8	69	14.2	89	20.4	3,010
2001	‡	7	‡	11	15.9	58	12.3	76	16.0	2,363
2002	‡	6	‡	18	13.7	50	12.0	74	13.7	2,002

Spearman's ρ	ψ	ψ	-0.30	-0.53	-0.48
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1 Population estimates are taken from the Michigan population estimates for 1990-2002.

2 Rates are not age adjusted. Hospitalization records with missing age are excluded.

3 Asthma hospitalization is defined as a primary discharge diagnosis of asthma, ICD-9-CM=493.XX.

4 Data Source: Michigan Inpatient Database, Bureau of Epidemiology, MDCH.

5 Mid-Michigan is defined by the Mid-Michigan Asthma Coalition coverage area (Clinton, Eaton, Ingham Counties).

‡ Insufficient data to compute a stable rate (number of events ≤ 20 or population < 5000).

ψ Insufficient data to compute Spearman Correlation Coefficient.

Sample Interpretation of Annual Rate:

In 2002, the rate of asthma hospitalization among children 5 to 14 years in Michigan was 13.7 per 10,000 population.

Sample Trend Interpretation:

Between 1990 and 2002, a significant overall trend in asthma hospitalization rates has not been observed for children 5 to 14 years in Michigan.

Counts and Rates (per 10,000) [1,2] of Asthma [3] Hospitalization [4] by Year for CHILDREN/ADULTS Aged 15 to 34 Years, for Clinton, Eaton, and Ingham Counties, Mid-Michigan [5], and the State of Michigan, 1990-2002.

Year	Clinton		Eaton		Ingham		Mid-Michigan		Michigan	
	Rate	Count	Rate	Count	Rate	Count	Rate	Count	Rate	Count
1990	‡	11	‡	16	4.7	54	5.0	81	9.1	2,709
1991	‡	10	‡	9	6.1	70	5.6	89	8.9	2,628
1992	‡	14	‡	15	6.5	73	6.5	102	9.8	2,839
1993	‡	14	‡	18	9.0	100	8.4	132	11.7	3,352
1994	‡	9	‡	17	7.4	81	6.9	107	10.9	3,081
1995	‡	11	‡	20	8.9	96	8.3	127	11.8	3,341
1996	‡	6	‡	16	8.1	87	7.2	109	11.5	3,220
1997	‡	12	‡	20	7.9	84	7.7	116	10.6	2,959
1998	‡	10	7.6	21	6.1	64	6.4	95	10.0	2,755
1999	‡	9	8.4	23	4.0	41	5.0	73	9.2	2,526
2000	‡	8	‡	13	6.9	71	6.3	92	9.2	2,502
2001	‡	7	‡	10	7.2	73	6.2	90	8.2	2,253
2002	‡	10	‡	16	6.6	67	6.3	93	7.7	2,104

Spearman's ρ	ψ	ψ	0.03	-0.11	-0.31
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1 Population estimates are taken from the Michigan population estimates for 1990-2002.

2 Rates are not age adjusted. Hospitalization records with missing age are excluded.

3 Asthma hospitalization is defined as a primary discharge diagnosis of asthma, ICD-9-CM=493.XX.

4 Data Source: Michigan Inpatient Database, Bureau of Epidemiology, MDCH.

5 Mid-Michigan is defined by the Mid-Michigan Asthma Coalition coverage area (Clinton, Eaton, Ingham Counties).

‡ Insufficient data to compute a stable rate (number of events ≤ 20 or population < 5000).

ψ Insufficient data to compute Spearman Correlation Coefficient.

Sample Interpretation of Annual Rate:

In 2002, the rate of asthma hospitalization among children and adults 15 to 34 years in Michigan was 7.7 per 10,000 population.

Sample Trend Interpretation:

Between 1990 and 2002, a significant overall trend in asthma hospitalization rates has not been observed for children and adults 15 to 34 years in Michigan.

**Counts and Rates (per 10,000) [1,2] of Asthma [3] Hospitalization [4] by Year for
ADULTS Aged 35 to 64 Years, for Clinton, Eaton, and Ingham Counties, Mid-
Michigan [5], and the State of Michigan, 1990-2002.**

Year	Clinton		Eaton		Ingham		Mid-Michigan		Michigan	
	Rate	Count	Rate	Count	Rate	Count	Rate	Count	Rate	Count
1990	11.9	25	11.8	40	11.7	98	11.7	163	14.8	4,694
1991	‡	13	9.1	32	11.8	101	10.3	146	15.0	4,838
1992	10.4	23	7.0	25	13.8	121	11.6	169	14.5	4,795
1993	11.8	27	9.0	33	12.8	114	11.7	174	15.9	5,369
1994	‡	18	9.8	37	9.8	89	9.5	144	16.0	5,509
1995	‡	18	11.9	46	13.1	120	11.9	184	15.6	5,493
1996	9.3	23	6.1	24	10.7	100	9.3	147	15.0	5,401
1997	8.6	22	8.4	34	10.8	102	9.9	158	13.8	5,065
1998	9.2	24	6.6	27	12.1	115	10.3	166	14.2	5,275
1999	11.7	31	7.7	32	11.6	111	10.6	174	14.7	5,547
2000	‡	15	8.0	34	13.7	131	10.9	180	13.6	5,264
2001	9.0	25	8.1	35	12.4	121	10.8	181	13.8	5,383
2002	‡	20	6.7	29	12.1	119	9.9	168	13.5	5,317

Spearman's ρ	ψ	-0.53	0.07	-0.31	-0.70**
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1 Population estimates are taken from the Michigan population estimates for 1990-2002.

2 Rates are not age adjusted. Hospitalization records with missing age are excluded.

3 Asthma hospitalization is defined as a primary discharge diagnosis of asthma, ICD-9-CM=493.XX.

4 Data Source: Michigan Inpatient Database, Bureau of Epidemiology, MDCH.

5 Mid-Michigan is defined by the Mid-Michigan Asthma Coalition coverage area (Clinton, Eaton, Ingham Counties).

‡ Insufficient data to compute a stable rate (number of events ≤ 20 or population < 5000).

** Correlation is statistically significant; p-value < 0.01 .

ψ Insufficient data to compute Spearman Correlation Coefficient.

Sample Interpretation of Annual Rate:

In 2002, the rate of asthma hospitalization among adults 35 to 64 years in Michigan was 13.5 per 10,000 population.

Sample Trend Interpretation:

Between 1990 and 2002, there has been a significant overall decrease in asthma hospitalization rates for adults 35 to 64 years in Michigan.

Counts and Rates (per 10,000) [1,2] of Asthma [3] Hospitalization [4] by Year for ADULTS Aged 65 Years and Older, for Clinton, Eaton, and Ingham Counties, Mid-Michigan [5], and the State of Michigan, 1990-2002.

Year	Clinton		Eaton		Ingham		Mid-Michigan		Michigan	
	Rate	Count	Rate	Count	Rate	Count	Rate	Count	Rate	Count
1990	38.5	21	‡	8	17.6	43	18.4	72	25.7	2,849
1991	‡	18	‡	10	10.1	25	13.2	53	24.4	2,757
1992	‡	17	21.2	21	20.9	53	22.2	91	23.9	2,754
1993	‡	13	‡	19	18.7	48	19.1	80	25.6	2,991
1994	36.2	22	‡	13	13.1	34	16.2	69	23.8	2,818
1995	‡	15	‡	16	15.8	41	16.7	72	20.9	2,502
1996	‡	16	‡	9	15.7	41	15.1	66	18.5	2,232
1997	‡	19	‡	12	14.8	39	15.8	70	16.8	2,033
1998	‡	12	‡	13	12.5	33	13.0	58	16.8	2,034
1999	‡	9	‡	9	14.1	37	12.3	55	17.2	2,090
2000	‡	6	‡	20	12.5	33	13.0	59	15.2	1,853
2001	‡	6	‡	13	12.8	34	11.6	53	16.5	2,023
2002	‡	8	17.9	22	11.2	30	12.9	60	18.1	2,234

Spearman's ρ	ψ	ψ	-0.52	-0.81**	-0.88**
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1 Population estimates are taken from the Michigan population estimates for 1990-2002.

2 Rates are not age adjusted. Hospitalization records with missing age are excluded.

3 Asthma hospitalization is defined as a primary discharge diagnosis of asthma, ICD-9-CM=493.XX.

4 Data Source: Michigan Inpatient Database, Bureau of Epidemiology, MDCH.

5 Mid-Michigan is defined by the Mid-Michigan Asthma Coalition coverage area (Clinton, Eaton, Ingham Counties).

‡ Insufficient data to compute a stable rate (number of events ≤ 20 or population < 5000).

** Correlation is statistically significant; p-value < 0.01 .

ψ Insufficient data to compute Spearman Correlation Coefficient.

Sample Interpretation of Annual Rate:

In 2002, the rate of asthma hospitalization among adults 65 years and older in Michigan was 18.1 per 10,000 population.

Sample Trend Interpretation:

Between 1990 and 2002, there has been a significant overall decrease in asthma hospitalization rates for adults 65 years and older in Michigan.

Counts and Rates (per 10,000) [1,2] of Asthma [3] Hospitalization [4] by Year for CHILDREN Aged Less Than 18 Years, for Clinton, Eaton, and Ingham Counties, Mid-Michigan [5], and the State of Michigan, 1990-2002.

Year	Clinton		Eaton		Ingham		Mid-Michigan		Michigan	
	Rate	Count	Rate	Count	Rate	Count	Rate	Count	Rate	Count
1990	16.2	27	11.4	29	20.7	149	18.0	205	31.7	8,063
1991	16.0	27	17.2	44	18.7	133	17.7	204	28.3	7,254
1992	19.5	33	19.7	51	22.0	155	20.9	239	29.9	7,735
1993	21.6	37	23.2	60	26.0	187	24.7	284	30.5	7,875
1994	‡	19	15.4	40	23.3	167	19.7	226	26.2	6,757
1995	12.3	21	16.4	43	20.7	144	18.4	208	31.9	8,221
1996	16.5	28	18.1	47	20.6	143	19.4	218	30.2	7,769
1997	‡	20	20.7	53	19.9	136	18.7	209	30.1	7,742
1998	17.0	30	11.9	31	15.3	103	14.8	164	21.8	5,594
1999	‡	18	13.0	34	19.7	130	16.6	182	21.6	5,546
2000	‡	20	14.8	38	23.5	155	19.5	213	26.3	6,693
2001	19.2	31	17.8	44	26.2	174	22.9	249	24.1	6,089
2002	14.2	23	22.2	55	24.6	164	22.4	242	21.3	5,359

Spearman's ρ	ψ	0.09	0.24	0.17	-0.68*
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1 Population estimates are taken from the Michigan population estimates for 1990-2002.

2 Rates are age adjusted to the 2000 US standard population by the direct standardization method. Hospitalization records with missing age are excluded.

3 Asthma hospitalization is defined as a primary discharge diagnosis of asthma, ICD-9-CM=493.XX.

4 Data Source: Michigan Inpatient Database, Bureau of Epidemiology, MDCH.

5 Mid-Michigan is defined by the Mid-Michigan Asthma Coalition coverage area (Clinton, Eaton, Ingham Counties).

‡ Insufficient data to compute a stable rate (number of events ≤ 20 or population < 5000).

* Correlation is statistically significant; p-value < 0.05 .

ψ Insufficient data to compute Spearman Correlation Coefficient.

Sample Interpretation of Annual Rate:

In 2002, the rate of asthma hospitalization among children less than 18 years in Michigan was 21.3 per 10,000 population.

Sample Trend Interpretation:

Between 1990 and 2002, there has been a significant overall decrease in asthma hospitalization rates for children less than 18 years in Michigan.

Counts and Rates (per 10,000) [1,2] of Asthma [3] Hospitalization [4] by Year for ADULTS Aged 18 Years and Older, for Clinton, Eaton, and Ingham Counties, Mid-Michigan [5], and the State of Michigan, 1990-2002.

Year	Clinton		Eaton		Ingham		Mid-Michigan		Michigan	
	Rate	Count	Rate	Count	Rate	Count	Rate	Count	Rate	Count
1990	14.5	54	9.5	62	11.0	192	11.1	308	14.7	9,727
1991	10.2	39	7.6	50	10.3	188	9.6	277	14.5	9,741
1992	13.0	52	9.2	59	12.8	230	11.8	341	14.5	9,862
1993	12.3	52	10.3	69	13.0	248	12.2	369	16.1	11,100
1994	11.9	49	9.0	62	9.6	192	9.8	303	15.7	10,852
1995	9.6	41	10.8	77	12.3	243	11.5	361	15.2	10,724
1996	10.0	44	6.5	46	10.6	211	9.6	301	14.5	10,289
1997	12.0	52	8.1	59	10.5	207	10.0	318	13.3	9,578
1998	9.2	42	7.5	56	10.4	206	9.5	304	13.4	9,695
1999	10.7	49	8.0	61	9.5	181	9.0	291	13.5	9,839
2000	6.4	29	8.4	64	11.4	225	9.8	318	12.5	9,193
2001	7.3	35	7.1	56	10.3	204	9.1	295	12.5	9,274
2002	7.5	36	8.3	65	10.2	205	9.3	306	12.5	9,337

Spearman's ρ	-0.79**	-0.45	-0.42	-0.67*	-0.80**
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1 Population estimates are taken from the Michigan population estimates for 1990-2002.

2 Rates are age adjusted to the 2000 US standard population by the direct standardization method. Hospitalization records with missing age are excluded.

3 Asthma hospitalization is defined as a primary discharge diagnosis of asthma, ICD-9-CM=493.XX.

4 Data Source: Michigan Inpatient Database, Bureau of Epidemiology, MDCH.

5 Mid-Michigan is defined by the Mid-Michigan Asthma Coalition coverage area (Clinton, Eaton, Ingham Counties).

* Correlation is statistically significant; p-value < 0.05.

** Correlation is statistically significant; p-value < 0.01.

Sample Interpretation of Annual Rate:

In 2002, the rate of asthma hospitalization among adults 18 years and older in Michigan was 12.5 per 10,000 population.

Sample Trend Interpretation:

Between 1990 and 2002, there has been a significant overall decrease in asthma hospitalization rates for adults 18 years and older in Michigan.

Clinton County

Counts and Rates (per 10,000) [1,2] of Asthma [3] Hospitalization [4] for Clinton County, 2000-2002.

		Count	Rate	95% Confidence Interval	
				Lower Limit	Upper Limit
Total Population		174	9.1	7.7	10.4
Sex	Male	76	8.4	6.5	10.3
	Female	98	10.0	8.0	12.0
Race ⁵	White	153	8.2	6.9	9.5
	Black	18	‡	‡	‡
Sex and Race ⁵	White Male	66	7.5	5.7	9.4
	White Female	87	9.0	7.1	10.9
	Black Male	10	‡	‡	‡
	Black Female	8	‡	‡	‡
Age (unadjusted)	0-4 Years	46	36.4	25.9	47.0
	5-14 Years	23	7.4	4.4	10.5
	15-34 Years	25	5.1	3.1	7.1
	35-64 Years	60	7.2	5.4	9.0
	65+ Years	20	‡	‡	‡
Age	<18 Years	74	15.0	11.6	18.5
	18+ Years	100	7.0	5.6	8.4

For comparison, State of Michigan and Mid-Michigan 3-year rates are located within the Hospitalization section of this report.

Counts and Rates (per 10,000) [1,2] of Asthma [3] Hospitalization [4] for Clinton County, 2000-2002, Comparable to the Healthy People 2010 Targets.

		Count	Rate	95% Confidence Interval	
				Lower Limit	Upper Limit
Age	0-4 Years ⁶	46	36.4	25.9	47.0
	5-64 Years	108	6.6	5.3	7.8
	65+ Years	20	‡	‡	‡
	<18 Years ⁶	74	13.9	10.7	17.0

For comparison, State of Michigan and Mid-Michigan 3-year rates are located within the Healthy People 2010 section of this report.

¹ Unless otherwise noted, rates are age adjusted to the 2000 US standard population by the direct standardization method. Hospitalization records with missing age are excluded.

² Population estimates are taken from the Michigan population estimates for 2001.

³ Asthma hospitalization is defined as a primary discharge diagnosis of asthma, ICD-9-CM=493.XX.

⁴ Data Source: Michigan Inpatient Database, Bureau of Epidemiology, MDCH.

⁵ For records that are missing data for race, race was assigned based on the 1990 census population for Michigan.

⁶ Not age adjusted in accordance with analysis prescribed by Healthy People 2010 Objectives.

‡ Insufficient data to compute a stable rate (number of events ≤20 or population <5000).

Eaton County

Counts and Rates (per 10,000) [1,2] of Asthma [3] Hospitalization [4] for Eaton County, 2000-2002.

		Count	Rate	95% Confidence Interval	
				Lower Limit	Upper Limit
Total Population		322	10.6	9.4	11.8
Sex	Male	140	9.8	8.1	11.4
	Female	182	11.2	9.6	12.9
Race ⁵	White	264	9.4	8.3	10.6
	Black	52	25.1	17.8	32.3
Sex and Race ⁵	White Male	110	8.5	6.9	10.1
	White Female	154	10.1	8.5	11.7
	Black Male	24	21.9	12.8	30.9
	Black Female	28	28.3	17.1	39.5
Age (unadjusted)	0-4 Years	91	47.2	37.5	56.9
	5-14 Years	39	8.6	5.9	11.3
	15-34 Years	39	4.6	3.2	6.1
	35-64 Years	98	7.6	6.1	9.1
	65+ Years	55	15.2	11.2	19.3
Age	<18 Years	137	18.3	15.3	21.4
	18+ Years	185	7.9	6.8	9.1

For comparison, State of Michigan and Mid-Michigan 3-year rates are located within the Hospitalization section of this report.

Counts and Rates (per 10,000) [1,2] of Asthma [3] Hospitalization [4] for Eaton County, 2000-2002, Comparable to the Healthy People 2010 Targets.

		Count	Rate	95% Confidence Interval	
				Lower Limit	Upper Limit
Age	0-4 Years ⁶	91	47.2	37.5	56.9
	5-64 Years	176	6.7	5.7	7.7
	65+ Years	55	15.2	11.2	19.2
	<18 Years ⁶	137	17.1	14.3	20.0

For comparison, State of Michigan and Mid-Michigan 3-year rates are located within the Healthy People 2010 section of this report.

1 Unless otherwise noted, rates are age adjusted to the 2000 US standard population by the direct standardization method. Hospitalization records with missing age are excluded.

2 Population estimates are taken from the Michigan population estimates for 2001.

3 Asthma hospitalization is defined as a primary discharge diagnosis of asthma, ICD-9-CM=493.XX.

4 Data Source: Michigan Inpatient Database, Bureau of Epidemiology, MDCH.

5 For records that are missing data for race, race was assigned based on the 1990 census population for Michigan.

6 Not age adjusted in accordance with analysis prescribed by Healthy People 2010 Objectives.

Ingham County

Counts and Rates (per 10,000) [1,2] of Asthma [3] Hospitalization [4] for Ingham County, 2000-2002.

		Count	Rate	95% Confidence Interval	
				Lower Limit	Upper Limit
Total Population		1127	14.1	13.3	15.0
Sex	Male	477	11.9	10.8	13.0
	Female	650	15.9	14.7	17.2
Race ⁵	White	731	11.4	10.6	12.3
	Black	356	33.4	29.5	37.2
Sex and Race ⁵	White Male	292	9.5	8.4	10.6
	White Female	439	13.0	11.7	14.2
	Black Male	160	27.4	22.3	32.5
	Black Female	196	38.7	32.9	44.5
Age (unadjusted)	0-4 Years	271	49.8	43.9	55.7
	5-14 Years	177	16.1	13.8	18.5
	15-34 Years	211	6.9	6.0	7.8
	35-64 Years	371	12.7	11.4	14.0
	65+ Years	97	12.2	9.7	14.6
Age	<18 Years	493	24.8	22.6	27.0
	18+ Years	634	10.6	9.8	11.5

For comparison, State of Michigan and Mid-Michigan 3-year rates are located within the Hospitalization section of this report.

Counts and Rates (per 10,000) [1,2] of Asthma [3] Hospitalization [4] for Ingham County, 2000-2002, Comparable to the Healthy People 2010 Targets.

		Count	Rate	95% Confidence Interval	
				Lower Limit	Upper Limit
Age	0-4 Years ⁶	271	49.8	43.9	55.7
	5-64 Years	759	11.4	10.6	12.2
	65+ Years	97	12.2	9.8	14.6
	<18 Years ⁶	493	25.0	22.8	27.3

For comparison, State of Michigan and Mid-Michigan 3-year rates are located within the Healthy People 2010 section of this report.

1 Unless otherwise noted, rates are age adjusted to the 2000 US standard population by the direct standardization method. Hospitalization records with missing age are excluded.

2 Population estimates are taken from the Michigan population estimates for 2001.

3 Asthma hospitalization is defined as a primary discharge diagnosis of asthma, ICD-9-CM=493.XX.

4 Data Source: Michigan Inpatient Database, Bureau of Epidemiology, MDCH.

5 For records that are missing data for race, race was assigned based on the 1990 census population for Michigan.

6 Not age adjusted in accordance with analysis prescribed by Healthy People 2010 Objectives.

Counts and Rates (per 1,000,000) [1,2] of Mortality [3] due to Asthma [4] by Year, All Ages, for Clinton, Eaton, and Ingham Counties, Mid-Michigan [5], and the State of Michigan, 1990-2002 [6].

Year	Clinton		Eaton		Ingham		Mid-Michigan		Michigan	
	Rate	Count	Rate	Count	Rate	Count	Rate	Count	Rate	Count
1990	‡	~	‡	~	‡	~	15.2	6	18.4	159
1991	‡	~	‡	~	31.0	7	22.2	8	20.5	179
1992	‡	~	‡	~	26.3	5	16.3	5	18.8	165
1993	‡	~	‡	~	‡	~	18.2	6	22.0	196
1994	‡	~	‡	~	31.1	7	25.1	9	21.1	193
1995	‡	~	56.8	~	21.7	5	30.6	11	23.1	216
1996	‡	~	‡	~	30.5	7	20.4	8	20.4	190
1997	‡	~	‡	~	‡	~	19.2	7	18.2	171
1998	‡	~	‡	~	30.6	7	28.9	11	22.7	217
1999	‡	~	‡	~	18.6	5	15.7	7	16.6	162
2000	‡	~	‡	~	‡	~	‡	~	16.7	164
2001	‡	~	‡	~	‡	~	‡	~	15.4	153
2002	‡	~	‡	~	24.1	6	16.9	7	15.1	152

- 1 Population estimates are taken from the Michigan population estimates for 1990-2002.
- 2 Rates are age adjusted to the 2000 US standard population by the direct standardization method.
- 3 Asthma death is defined as a primary cause of death as asthma, ICD-9=493.XX and ICD-10=J45 or J46.
- 4 Data Source: Michigan Resident Death Files, Bureau of Epidemiology, MDCH.
- 5 Mid-Michigan is defined by the Mid-Michigan Asthma Coalition coverage area (Clinton, Eaton, Ingham Counties).
- 6 Due to a change in coding for asthma deaths beginning in 1999, rates calculated for 1999-2002 are not comparable to rates calculated for 1990-1998.
- ‡ Insufficient data to compute a stable rate (number of events <5 or population <5000).
- ~ Due to a low number of events, data are suppressed.

Sample Interpretation of Annual Rate:

In 2002, the rate of asthma mortality in Michigan was 15.1 per 1,000,000 population.

Counts and Rates (per 10,000) [1,2] of Asthma [3] Hospitalization [4] by Year for CHILDREN Aged Less Than 18 Years, for Clinton, Eaton, and Ingham Counties, Mid-Michigan [5], and the State of Michigan, 1990-2002, Compared to the Healthy People 2010 Target (Objective 1-9a).

Year	HP 2010 Objective	Clinton		Eaton		Ingham		Mid-Michigan		Michigan	
		Rate	Count	Rate	Count	Rate	Count	Rate	Count	Rate	Count
1990	17.3	16.2	27	11.3	29	21.8	149	18.5	205	32.8	8,063
1991	17.3	15.9	27	16.9	44	19.5	133	18.3	204	29.2	7,254
1992	17.3	19.3	33	19.5	51	22.6	155	21.3	239	30.9	7,735
1993	17.3	21.3	37	22.7	60	27.1	187	25.2	284	31.2	7,875
1994	17.3	‡	19	15.1	40	24.3	167	20.0	226	26.6	6,757
1995	17.3	11.8	21	16.0	43	21.1	144	18.4	208	32.1	8,221
1996	17.3	15.7	28	17.4	47	21.0	143	19.3	218	30.1	7,769
1997	17.3	‡	20	19.6	53	20.1	136	18.6	209	30.0	7,742
1998	17.3	16.7	30	11.4	31	15.5	103	14.7	164	21.7	5,594
1999	17.3	‡	18	12.6	34	19.8	130	16.4	182	21.4	5,546
2000	17.3	‡	20	14.1	38	23.7	155	19.3	213	26.0	6,693
2001	17.3	17.4	31	16.5	44	26.5	174	22.6	249	23.7	6,089
2002	17.3	13.0	23	20.8	55	25.0	164	22.1	242	20.8	5,359

Spearman's ρ	ψ	0.03	0.15	0.13	-0.79**
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1 Population estimates are taken from the Michigan population estimates for 1990-2002.

2 Rates are not age adjusted. Hospitalization records with missing age are excluded.

3 Asthma hospitalization is defined as a primary discharge diagnosis of asthma, ICD-9-CM=493.XX.

4 Data Source: Michigan Inpatient Database, Bureau of Epidemiology, MDCH.

5 Mid-Michigan is defined by the Mid-Michigan Asthma Coalition coverage area (Clinton, Eaton, Ingham Counties).

‡ Insufficient data to compute a stable rate (number of events ≤ 20 or population < 5000).

** Correlation is statistically significant; p-value < 0.01 .

ψ Insufficient data to compute Spearman Correlation Coefficient.

Sample Interpretation of Annual Rate:

In 2002, the rate of asthma hospitalization among children less than 18 years in Michigan was 20.8 per 10,000 population.

Sample Trend Interpretation:

Between 1990 and 2002, there has been a significant overall decrease in asthma hospitalization rates for children less than 18 years in Michigan.

Counts and Rates (per 10,000) [1,2] of Asthma [3] Hospitalization [4] by Year for CHILDREN Aged 0 to 4 Years, for Clinton, Eaton, and Ingham Counties, Mid-Michigan [5], and the State of Michigan, 1990-2002, Compared to the Healthy People 2010 Target (Objective 24-2).

Year	HP 2010 Objective	Clinton		Eaton		Ingham		Mid-Michigan		Michigan	
		Rate	Count	Rate	Count	Rate	Count	Rate	Count	Rate	Count
1990	25.0	‡	11	‡	16	39.6	83	34.3	110	66.1	4,712
1991	25.0	‡	15	47.4	32	31.5	66	35.1	113	57.1	4,106
1992	25.0	‡	22	34.0	23	30.7	64	34.0	109	64.4	4,638
1993	25.0	‡	17	35.5	24	52.5	108	46.9	149	59.6	4,291
1994	25.0	‡	11	‡	19	50.2	101	41.9	131	53.2	3,783
1995	25.0	‡	11	‡	20	36.5	71	33.4	102	63.9	4,457
1996	25.0	‡	15	31.7	21	41.0	78	38.0	114	59.6	4,092
1997	25.0	‡	~	50.1	~	34.9	65	34.5	102	59.2	4,019
1998	25.0	‡	8	‡	17	32.4	59	28.8	84	40.5	2,734
1999	25.0	‡	11	‡	17	34.7	62	31.2	90	40.6	2,725
2000	25.0	‡	10	38.0	25	42.5	76	38.4	111	48.8	3,257
2001	25.0	‡	21	48.2	31	50.7	92	50.0	144	50.5	3,341
2002	25.0	‡	15	54.5	35	56.2	103	53.1	153	45.8	3,039

Spearman's ρ	Ψ	Ψ	0.41	0.28	-0.76**
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1 Population estimates are taken from the Michigan population estimates for 1990-2002.

2 Rates are not age adjusted. Hospitalization records with missing age are excluded.

3 Asthma hospitalization is defined as a primary discharge diagnosis of asthma, ICD-9-CM=493.XX.

4 Data Source: Michigan Inpatient Database, Bureau of Epidemiology, MDCH.

5 Mid-Michigan is defined by the Mid-Michigan Asthma Coalition coverage area (Clinton, Eaton, Ingham Counties).

‡ Insufficient data to compute a stable rate (number of events ≤ 20 or population < 5000).

~ Due to a low number of events, data are suppressed.

** Correlation is statistically significant; p-value < 0.01 .

Ψ Insufficient data to compute Spearman Correlation Coefficient.

Sample Interpretation of Annual Rate:

In 2002, the rate of asthma hospitalization among children 0 to 4 years in Michigan was 45.8 per 10,000 population.

Sample Trend Interpretation:

Between 1990 and 2002, there has been a significant overall decrease in asthma hospitalization rates for children 0 to 4 years in Michigan.

Counts and Rates (per 10,000) [1,2] of Asthma [3] Hospitalization [4] by Year for CHILDREN/ADULTS Aged 5 to 64 Years, for Clinton, Eaton, and Ingham Counties, Mid-Michigan [5], and the State of Michigan, 1990-2002, Compared to the Healthy People 2010 Target (Objective 24-2).

Year	HP 2010 Objective	Clinton		Eaton		Ingham		Mid-Michigan		Michigan	
		Rate	Count	Rate	Count	Rate	Count	Rate	Count	Rate	Count
1990	7.7	10.3	49	9.0	67	10.7	215	10.2	331	14.0	10,229
1991	7.7	6.5	33	6.8	52	11.1	230	9.4	315	13.7	10,132
1992	7.7	9.2	46	8.4	66	12.7	268	11.1	380	13.6	10,205
1993	7.7	11.6	59	10.8	86	12.6	279	12.0	424	15.5	11,693
1994	7.7	6.8	35	8.9	70	9.9	224	9.2	329	14.5	11,008
1995	7.7	6.9	36	10.4	84	12.2	275	11.0	395	15.5	11,986
1996	7.7	7.8	41	7.7	63	10.3	235	9.4	339	15.0	11,734
1997	7.7	9.3	49	8.0	67	10.6	239	9.7	355	14.2	11,268
1998	7.7	9.6	52	6.7	57	9.8	217	9.0	326	13.2	10,521
1999	7.7	9.1	47	8.0	69	9.8	212	9.0	328	13.2	10,570
2000	7.7	6.1	33	6.6	57	12.3	271	9.9	361	13.3	10,776
2001	7.7	7.1	39	6.4	56	11.3	252	9.5	347	12.3	9,999
2002	7.7	6.5	36	7.3	63	10.6	236	9.1	335	11.5	9,423

Spearman's ρ	-0.37	-0.63*	-0.28	-0.49	-0.63*
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- 1 Population estimates are taken from the Michigan population estimates for 1990-2002.
- 2 Rates are age adjusted to the 2000 US standard population by the direct standardization method. Hospitalization records with missing age are excluded.
- 3 Asthma hospitalization is defined as a primary discharge diagnosis of asthma, ICD-9-CM=493.XX.
- 4 Data Source: Michigan Inpatient Database, Bureau of Epidemiology, MDCH.
- 5 Mid-Michigan is defined by the Mid-Michigan Asthma Coalition coverage area (Clinton, Eaton, Ingham Counties).

* Correlation is statistically significant; p-value < 0.05.

Sample Interpretation of Annual Rate:

In 2002, the rate of asthma hospitalization among children and adults 5 to 64 years in Michigan was 11.5 per 10,000 population.

Sample Trend Interpretation:

Between 1990 and 2002, there has been a significant overall decrease in asthma hospitalization rates for children and adults 5 to 64 years in Michigan.

Counts and Rates (per 10,000) [1,2] of Asthma [3] Hospitalization [4] by Year for ADULTS Aged 65 Years and Older, for Clinton, Eaton, and Ingham Counties, Mid-Michigan [5], and the State of Michigan, 1990-2002, Compared to the Healthy People 2010 Target (Objective 24-2).

Year	HP 2010 Objective	Clinton		Eaton		Ingham		Mid-Michigan		Michigan	
		Rate	Count	Rate	Count	Rate	Count	Rate	Count	Rate	Count
1990	11.0	39.3	21	‡	8	17.5	43	18.5	72	25.8	2,849
1991	11.0	‡	18	‡	10	10.3	25	13.5	53	24.3	2,757
1992	11.0	‡	17	21.3	21	21.0	53	22.5	91	23.9	2,754
1993	11.0	‡	13	‡	19	19.5	48	19.7	80	25.5	2,991
1994	11.0	35.5	22	‡	13	13.0	34	16.0	69	23.9	2,818
1995	11.0	‡	15	‡	16	15.8	41	16.6	72	20.9	2,502
1996	11.0	‡	16	‡	9	15.6	41	15.1	66	18.6	2,232
1997	11.0	‡	19	‡	12	14.9	39	15.9	70	16.8	2,033
1998	11.0	‡	12	‡	13	12.6	33	13.1	58	16.8	2,034
1999	11.0	‡	9	‡	9	14.1	37	12.3	55	17.2	2,090
2000	11.0	‡	6	‡	20	12.6	33	13.1	59	15.2	1,853
2001	11.0	‡	6	‡	13	12.8	34	11.6	53	16.5	2,023
2002	11.0	‡	8	17.7	22	11.2	30	12.9	60	18.1	2,234

Spearman's ρ	Ψ	Ψ	-0.52	-0.81**	-0.87**
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1 Population estimates are taken from the Michigan population estimates for 1990-2002.

2 Rates are age adjusted to the 2000 US standard population by the direct standardization method. Hospitalization records with missing age are excluded.

3 Asthma hospitalization is defined as a primary discharge diagnosis of asthma, ICD-9-CM=493.XX.

4 Data Source: Michigan Inpatient Database, Bureau of Epidemiology, MDCH.

5 Mid-Michigan is defined by the Mid-Michigan Asthma Coalition coverage area (Clinton, Eaton, Ingham Counties).

‡ Insufficient data to compute a stable rate (number of events ≤ 20 or population < 5000).

** Correlation is statistically significant; p-value < 0.01 .

Ψ Insufficient data to compute Spearman Correlation Coefficient.

Sample Interpretation of Annual Rate:

In 2002, the rate of asthma hospitalization among adults 65 years and older in Michigan was 18.1 per 10,000 population.

Sample Trend Interpretation:

Between 1990 and 2002, there has been a significant overall decrease in asthma hospitalization rates for adults 65 years and older in Michigan.

Section 6: Data Sources

Name: Michigan Behavioral Risk Factor Surveillance System

Acronym: BRFSS

Basic Purpose and History: The BRFSS is a source of estimates of the prevalence of certain health behaviors, conditions, and practices associated with leading causes of death. Michigan has conducted the BRFSS survey since 1987. Asthma related questions were added to the survey in 2000.

Data Collection Process: Annual estimates are based on data collected from a random-digit dial telephone survey of a sample of Michigan households. It is a population-based representative sample of non-institutionalized Michigan residents. The data are weighted to represent estimates for the general adult population. BRFSS interviewers use a Computer Assisted Telephone Interviewing (CATI) system, which provides the interviewer with prompts. The interviewer types the respondent's responses directly onto the computer screen, providing quality control and minimizing interviewer error.

Population Included: A record is a completed telephone interview. The selected respondent must be a Michigan resident, 18 years of age or older who lives in a private residence and has a telephone. One randomly selected adult from a household is interviewed.

Asthma Data: There are two core questions dedicated to estimating asthma prevalence for the general population of adults. Michigan has opted to include the asthma module questions that include information about child prevalence and disease management/control. Finally, Michigan has also developed questions regarding work-related asthma. The following are the questions included on the Michigan BRFSS survey in 2001 regarding asthma:

Asthma Prevalence Questions for Adults:

- Have you ever been told by a doctor, nurse, or other health professional that you had asthma?
- Do you still have asthma?

Asthma Prevalence Questions for Children in the Household:

- Earlier you said there were <number> children, age 17 or younger, living in your household. How many of these children have ever been diagnosed with asthma?
- How many of these children/does this child still have asthma?

Additional Information: For more information about the BRFSS and national data for comparison, visit <http://www.cdc.gov/brfss/index.htm>. For a complete report of the Michigan BRFSS Survey, visit <http://www.michigan.gov/mdch/0,1607,7-132--12702--,00.html>.

Name: Michigan Inpatient Database

Acronym: MIDB

Basic Purpose and History: These data help support the State of Michigan health planning activities and are used by facilities themselves for internal evaluation. The Michigan Department of Community Health (MDCH) has purchased data since 1982.

Data Collection Process: Data are collected throughout a patient hospital stay by clinical and administrative staff and filed within a medical record. Hospital medical record personnel ascertain and keypunch information from these records. Some small hospitals complete data collection forms and send these directly to Michigan Health and Hospital Association (MHHA)

for processing. Depending on the facility, data are submitted on a voluntary basis monthly, quarterly, or annually to MHHA. Because data formats often differ by hospital, all coding is converted into standard formats at MHHA. The public use file provided to MDCH is stripped of all patient, provider, and hospital identifiers.

Population Included: Records include all hospital discharges from any of Michigan's reporting acute care hospitals or Michigan residents discharged from acute care hospitals in contiguous states. It includes virtually all hospitalizations in Michigan and for Michigan residents.

Asthma Data: The MIDB includes information on discharge diagnoses, which in the case of asthma includes the International Classification of Disease, Version 9, Clinical Modification (ICD-9-CM) codes 493.00-493.99. Procedure codes for treatments administered during the inpatient stay are also maintained in the dataset.

Additional Information: For the 2003 report on the *Michigan Hospital Profiles Project* published by MHHA, visit <http://www.michiganhospitalprofiles.org/>. For the latest data regarding preventable hospitalizations in Michigan, visit <http://www.mdch.state.mi.us/pha/osr/chi/hosp/frame.html>. The National Hospital Discharge Survey (NHDS) collects national data comparable to the MIDB. For more information about the NHDS and data for comparison, visit <http://www.cdc.gov/nchs/about/major/hdasd/nhds.htm>.

Name: Michigan Resident Death Files

Acronym: MRDF

Basic Purpose and History: The death certificate database is a high quality computerized data set containing demographic and cause of death information for all Michigan residents (out of state deaths included) and non-Michigan residents dying in Michigan. Death certificates are one of public health's vital records for monitoring the health of citizens. Death certificates have been collected in Michigan since 1897.

Data Collection Process: A funeral director, or another individual responsible for disposing of the body, completes the demographic and disposition components of the death certificate. When applicable, an attending physician or other hospital medical staff completes the portion of the death certificate describing the death (time, date, place, and immediate/underlying cause). A county medical examiner completes this section in all unexpected deaths including fatal injuries. The death certificate is then sent to the local registrar who verifies that the document has been properly filled out. If not, it is returned to the appropriate person for revision. Certificates for Michigan residents dying out-of-state are provided by those states (primarily Indiana, Ohio, and Wisconsin). Instructional materials to complete the death certificate are available at the state and local level for doctors, hospitals, medical examiners, and funeral directors. Michigan funeral director training also includes an annual seminar on death certificate completion.

Population Included: All in-state occurrences regardless of the state of residence and all Michigan residents regardless of location of death are included.

Asthma Data: The MRDF includes information on causes of death, which in the case of asthma includes the International Classification of Disease (ICD), Version 9 codes 493 (1990-1998) and Version 10 codes J45 and J46 (1999-present).

Additional Information: For more data regarding Michigan mortality, visit <http://www.mdch.state.mi.us/pha/osr/index.asp?Id=4>. The National Center for Health Statistics maintains the National Vital Statistics System that provides a natural comparison to the MRDF. For more information, visit <http://www.cdc.gov/nchs/about/major/dvs/mortdata.htm>.

Section 7: Methods

Topic 1: Prevalence

Prevalence is the proportion of individuals in a population who have the disease at a point in time or during a given time period. It is often used to describe the health burden on a given population.

Prevalence is computed by dividing the number of existing cases at a particular point or period in time by the total population from which the cases came. It is often multiplied by 100 and expressed as a percent.

$$\text{Prevalence} = \frac{\text{number of existing cases of disease}}{\text{total population}}$$

In this report, prevalence estimates are generated in the analysis of data from the Behavioral Risk Factor Surveillance System.

Topic 2: Incidence Rate

The incidence rate expresses the rate at which events occur in a population at risk at any given point in time during a defined time period. Rates presented in this report are used to estimate annual incidence for aggregates of individuals, defined by geographic area and demographic characteristics, over a given time period.

The numerator of the incidence rate is the number of new events in the population during a given time period. The denominator is the average population estimated for that same time period multiplied by the number of years in the interval. The use of this denominator assumes that the population and its demographic composition are relatively stable.

The population at the midpoint of a given time interval is used to estimate the average population over the entire interval. This is then multiplied by the number of years in the interval so that an *annual* rate is generated. For example, to compute a rate of asthma hospitalizations for 1998 through 2000, the population in 1999 (midpoint) multiplied by 3 is used as the denominator. Rates for single years are calculated using the estimated population for that year.

$$\text{Annual Incidence Rate} = \frac{\text{number of new events during given time period}}{\text{average population X number of years in time period}}$$

Incidence rates are generally multiplied by a factor of 10 so that they can be better understood in terms of a population. For asthma hospitalizations, rates are multiplied by 10,000, whereas for asthma deaths, rates are multiplied by 1,000,000.

In this report, incidence rates are generated in the analysis of data from the Michigan Inpatient Database, Michigan Resident Death File.

Topic 3: Age Adjustment by Direct Standardization

Populations often differ in their distribution of age, which may in turn affect the overall rate of events in that population. For example, if one population has a larger number of young children than another, it could demonstrate a higher asthma hospitalization rate simply due to its age structure. Therefore, when comparing rates of events in populations of different age distributions, it is important to account for those differences. In this report, age structure differences are accounted for in overall rates using direct standardization methodology to compute age-adjusted rates. Rates that are not age adjusted are referred to as crude rates.

An age-adjusted rate is a weighted average of age group specific rates in the population under study. The age group specific rates are weighted by the number of people in each age group of a selected *standard* population. When two or more age-adjusted rates are computed using the same *standard* population, they may be compared. Age-adjusted rates are presented in this report so that comparisons can be made between geographic subgroups (ex. County vs. County) and demographic subgroups (ex. White vs. Black). The *standard* population used in the calculation of age-adjusted rates in this report is the 2000 United States Standard Population.

To compute an age-adjusted incidence rate, the first step is to compute the comprising age specific rates. These are then multiplied by the corresponding age specific weight, i.e. the proportion of people in a particular age strata in the *standard* population. The products of these calculations are then summed and divided by the sum of all the age specific weights.

$$\text{Age-Adjusted Incidence Rate} = \frac{\text{Sum of (age specific rate X age specific weight)}}{\text{Sum of age specific weights}}$$

In this report, age-adjusted rates are generated in the analysis of data from the Michigan Inpatient Database and the Michigan Resident Death File.

Topic 4: Confidence Interval

The purpose of a confidence interval (CI) is to estimate the statistical uncertainty around a particular measure. For example, the *estimated* prevalence of asthma among Michigan adults is 8.8%, with a 95% confidence interval of 7.8% to 9.8%; we are 95% confident that the *true* prevalence in the population is no less than 7.8% and no greater than 9.8%.

In this report, 95% confidence intervals are provided for average annual incidence rates.

The confidence interval formula for a crude incidence rate is based on the Poisson distribution. The upper and lower limits are often multiplied by an appropriate factor of 10: 10,000 for asthma hospitalization rates and 1,000,000 for asthma mortality rates.

$$\text{Crude Incidence Rate CI} = \text{IR}_c \pm 1.96 \times \left(\frac{\text{IR}_c}{n} \right)^{1/2}$$

Where IR_c = crude incidence rate
 n = denominator of the rate

The confidence interval formula for an age-adjusted incidence rate is based on the Poisson distribution. The upper and lower limits are often multiplied by an appropriate factor of 10 – 10,000 for asthma hospitalization rates and 1,000,000 for asthma mortality rates.

$$\text{Age-Adjusted Incidence Rate CI} = \text{IR}_a \pm 1.96 \times \left(\frac{\text{Sum } (W^2 \times I)}{(\text{Sum } W)^2} \right)^{1/2}$$

Where IR_a = age-adjusted incidence rate
 W = age specific weights from the *standard* population
 I = variance of crude age specific rates

Confidence intervals can be used as a method to test whether a specific measure is statistically different between groups. For example, in comparing a county specific asthma hospitalization rate with that of the State of Michigan, they are considered statistically different if their confidence intervals do not overlap.

Topic 5: Data Suppression

Incidence rate estimates calculated with a small number of events or population sizes are statistically unstable. They exhibit wide confidence intervals indicative of great variability. In this report, data suppression rules are enforced so that the data presented are reliable. For demographic or geographic subgroups where there is less than or equal to 20 hospitalizations or less than 5000 population, asthma hospitalization rates are not presented. Mortality rates are suppressed when there is less than 5 deaths or less than 5000 population. In addition, to protect the identity of persons who have been hospitalized or died, counts less than 5 are not presented in this report.

Topic 6: Trend Analysis

To determine if there is an overall trend in annual asthma hospitalization and mortality rates over time, the Spearman Correlation Coefficient and its accompanying statistical Rank

Correlation Test were utilized. This test assesses whether there is a statistically significant monotonic relationship between 2 variables, in this case year and rate.

The Spearman Correlation Coefficient (ρ) ranges from -1.0 to 1.0 . If the coefficient equals -1.0 , it indicates a perfect negative correlation, where each year has a lower hospitalization rate than the previous year. If the coefficient equals 1.0 , it indicates a perfect positive correlation, where each year has a higher hospitalization rate than the previous year. As the correlation coefficient approaches 0.0 , from either direction, the relationship between the 2 variables weakens. For example, a correlation coefficient of 0.90 indicates a stronger positive relationship between 2 variables than a coefficient of 0.50 .

The p-value of the Rank Correlation test ranges from 0.0 to 1.0 and gives the probability of finding a significant overall monotonic trend in the asthma hospitalization rate data when, in reality, no trend exists. Again, the standard used to assess the significance of a statistical test is $p\text{-value} = 0.05$. A p value less than or equal to 0.05 indicates that there is at most a 5% chance of observing a trend, given that, in reality, rates are stable. In this case, the result is considered statistically significant. If the p value is greater than 0.05 , chance cannot be excluded as a likely explanation for the observed trend, so the result is not considered statistically significant.

From this, it follows that:

- If there is a statistically significant **increase** in asthma hospitalization rates over time, the Spearman Correlation Coefficient will be **positive** and the p-value for the test will be **less** than 0.05 .
- If there is a statistically significant **decrease** in asthma hospitalization rates over time, the Spearman Correlation Coefficient will be **negative** and the p-value for the test will be **less** than 0.05 .

IMPORTANT: This is a crude analysis that simply identifies whether there is an **overall** increase or decrease in the asthma hospitalization or mortality rates. This statistical test does not determine the significance of more complex trend patterns. There is no way to know from these statistics if a specific event or series of events caused an observed change in rates.

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