

Epidemiology of Asthma

In the Southwest Michigan Counties of

Berrien, Cass, and VanBuren

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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 Southwest Michigan [3] and the State of Michigan.

	Children (<18 Years)	Adults (≥18 Years)
	2002	2003
Berrien	3,740	11,353
Cass	1,139	3,645
VanBuren	1,905	5,339
Southwest Michigan	6,784	20,337
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 Southwest Michigan is defined by the Southwest Michigan Asthma Coalition coverage area (Berrien, Cass, VanBuren 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.

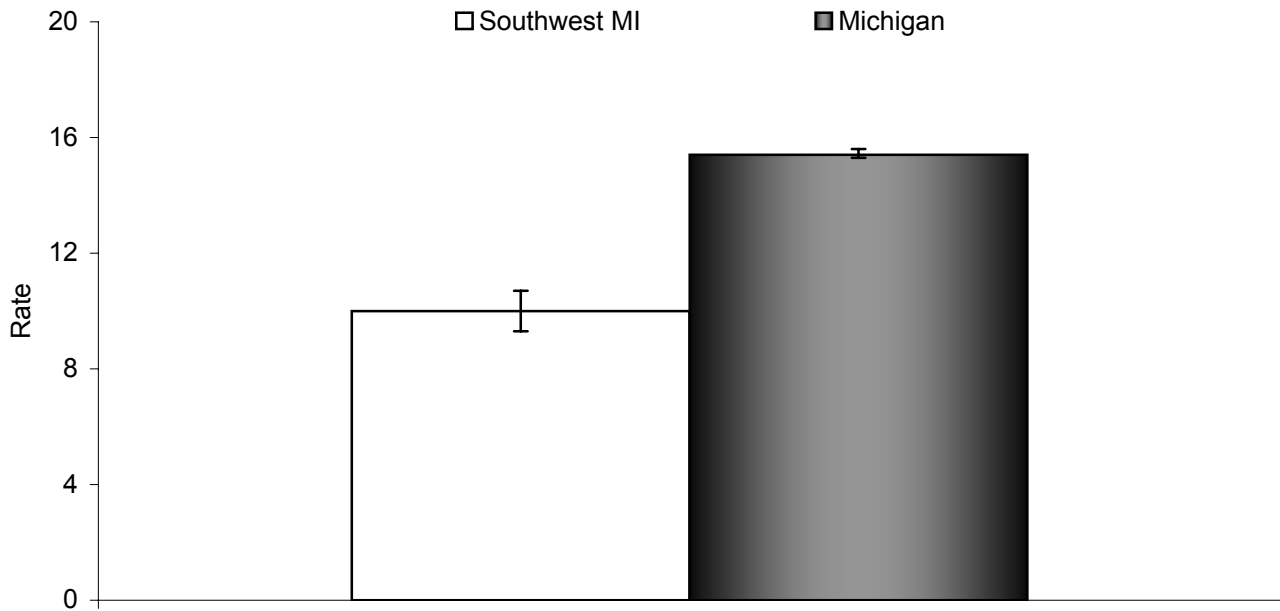
These data are the number of inpatient hospitalizations for asthma. This is not the same as the number of individual people hospitalized for asthma. An individual can be hospitalized more than once for the same condition during the study period and multiple hospitalizations cannot be distinguished from 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 Southwest Michigan [4] and the State of Michigan, All Ages, 2000-2002.



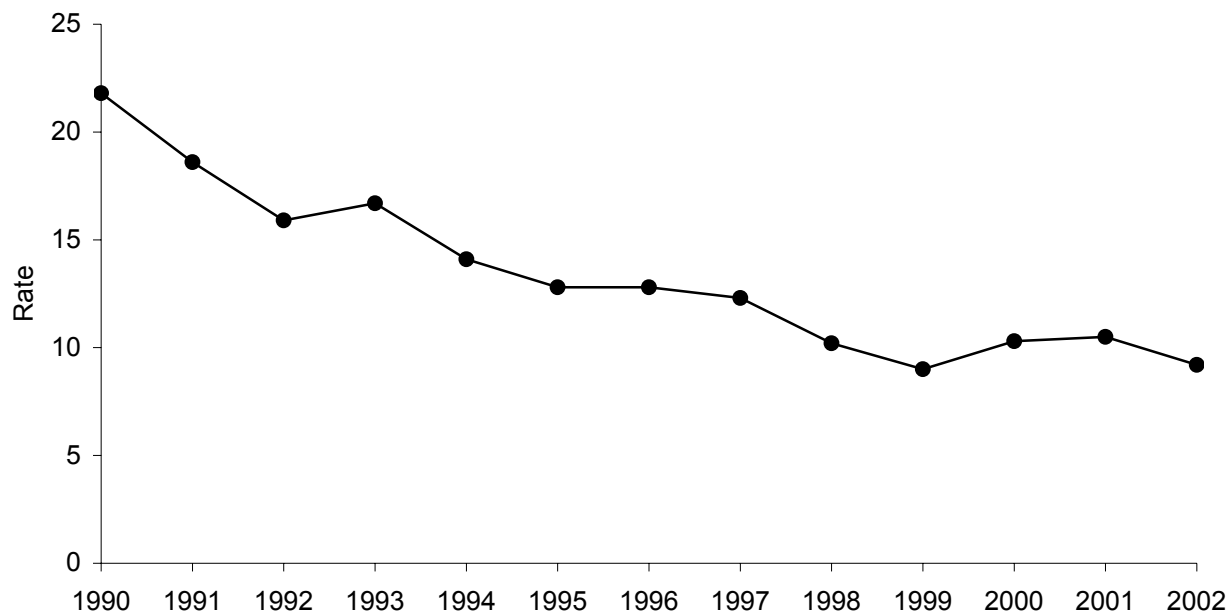
- 1 Rates are age adjusted to the 2000 US standard population by the direct standardization method. Hospitalization records with missing age are excluded.
- 2 Population estimates are taken from the Michigan population estimates for 2001.
- 3 Asthma hospitalization is defined as a primary discharge diagnosis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

	Total Population
Southwest MI Rate	10.0
95% CI	9.3 , 10.7
Count	865
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 Southwest Michigan, 2000-2002, is 288.
- ✧ Southwest 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 Southwest 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 Southwest Michigan is defined by the Southwest Michigan Asthma Coalition coverage area (Berrien, Cass, VanBuren Counties).

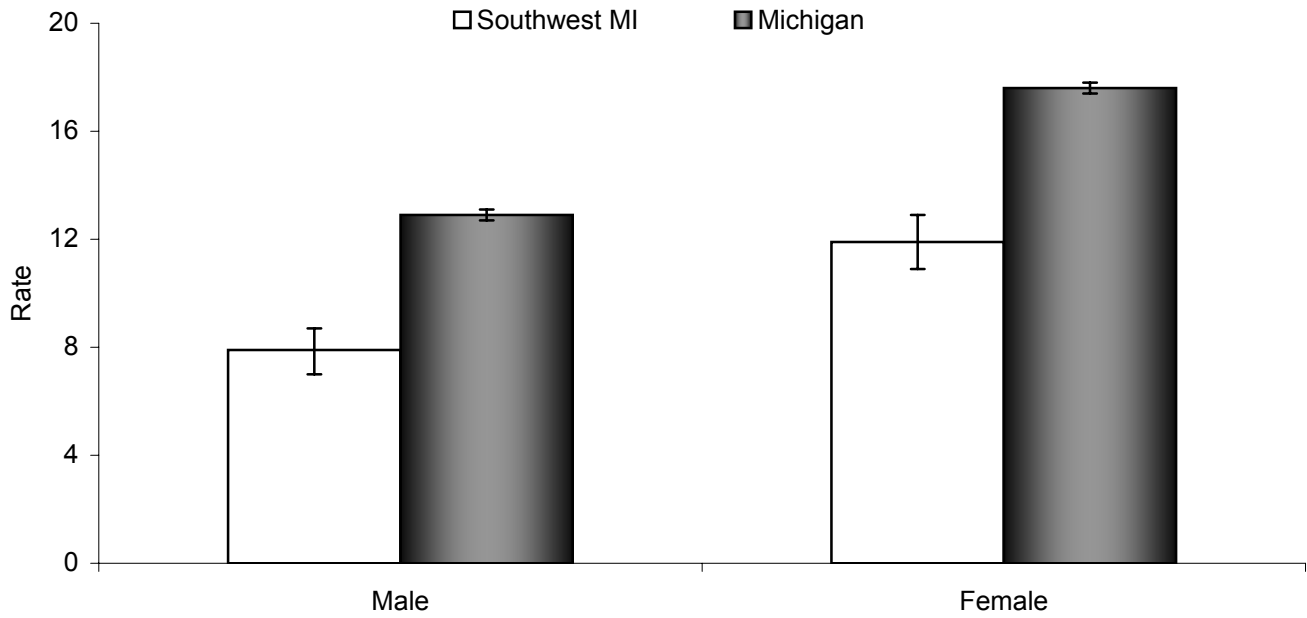
Year	Total Population	
	Rate	Count
1990	21.8	648
1991	18.6	550
1992	15.9	466
1993	16.7	492
1994	14.1	409
1995	12.8	372
1996	12.8	369
1997	12.3	352
1998	10.2	290
1999	9.0	259
2000	10.3	297
2001	10.5	305
2002	9.2	263

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 in Southwest Michigan ($\rho = -0.93$, $p < 0.01$).

See appendix page 36 for supporting data.

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



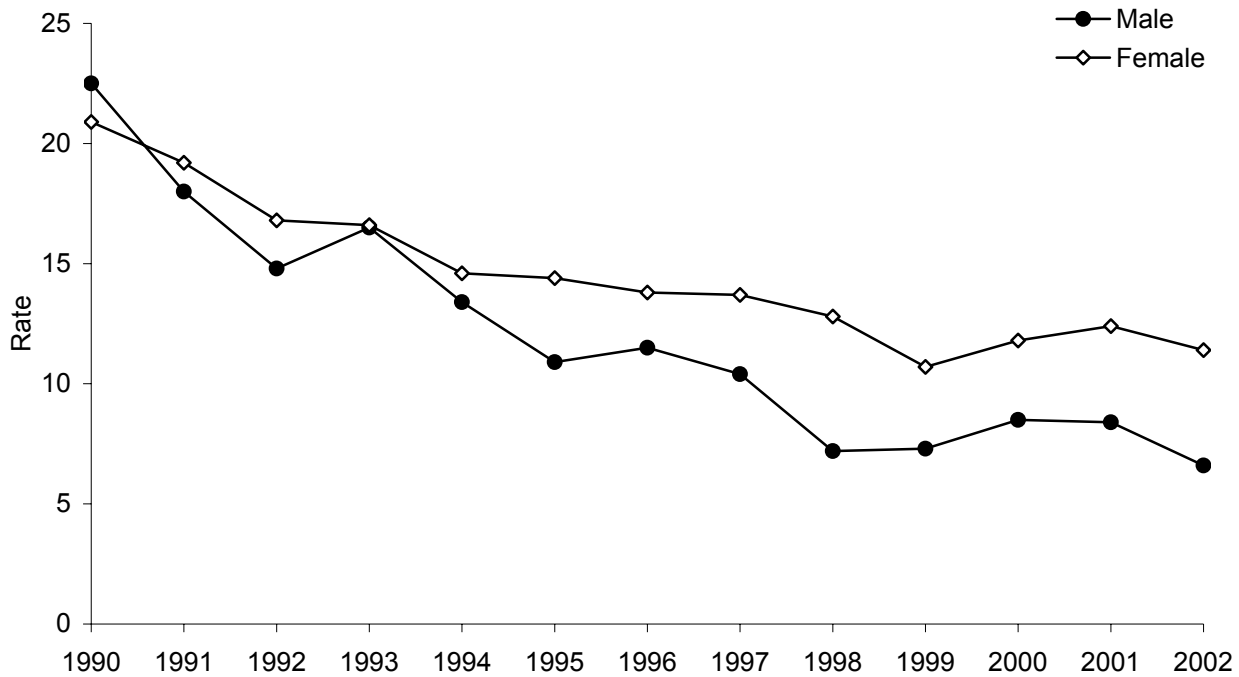
- 1 Rates are age adjusted to the 2000 US standard population by the direct standardization method. Hospitalization records with missing age are excluded.
- 2 Population estimates are taken from the Michigan population estimates for 2001.
- 3 Asthma hospitalization is defined as a primary discharge diagnosis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

	Male	Female
Southwest MI Rate	7.9	11.9
95% CI	7.0 , 8.7	10.9 , 12.9
Count	335	530
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 Southwest Michigan are significantly lower than the respective rates for the State of Michigan as a whole, 2000-2002.
- ✧ In Southwest 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 Southwest 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 Southwest Michigan is defined by the Southwest Michigan Asthma Coalition coverage area (Berrien, Cass, VanBuren Counties).

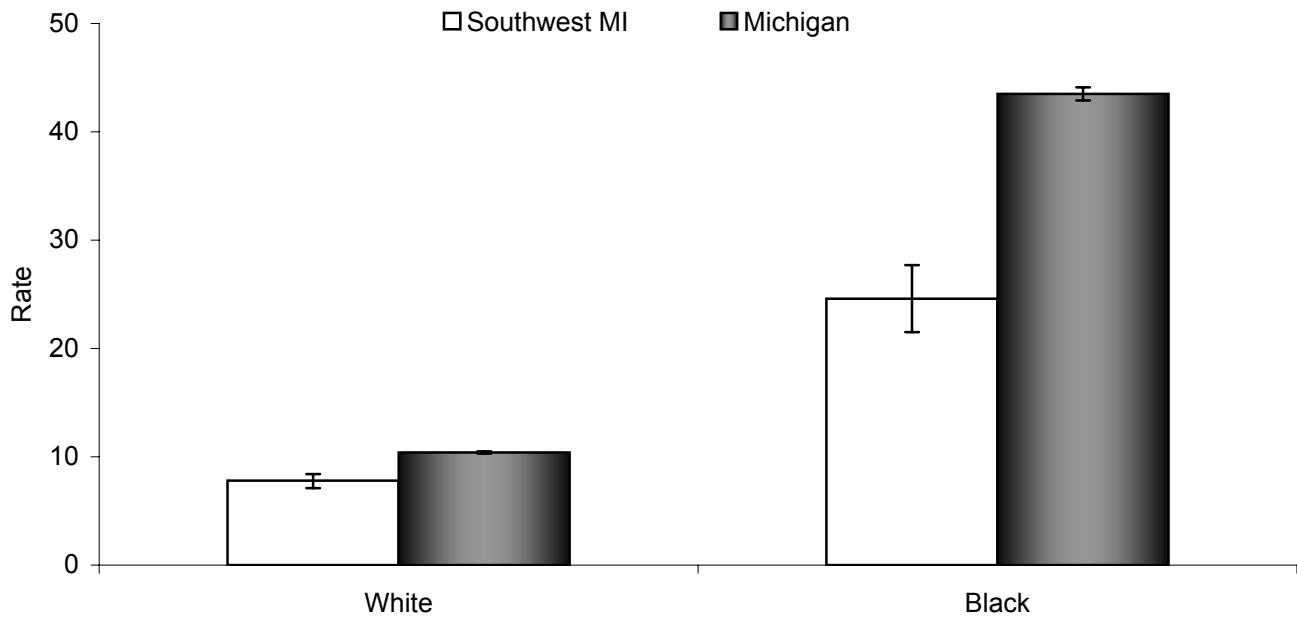
Year	Male		Female	
	Rate	Count	Rate	Count
1990	22.5	336	20.9	312
1991	18.0	266	19.2	284
1992	14.8	218	16.8	248
1993	16.5	243	16.6	249
1994	13.4	193	14.6	216
1995	10.9	160	14.4	212
1996	11.5	166	13.8	203
1997	10.4	152	13.7	200
1998	7.2	101	12.8	189
1999	7.3	103	10.7	156
2000	8.5	122	11.8	175
2001	8.4	119	12.4	186
2002	6.6	94	11.4	169

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 both the male and female populations in Southwest Michigan (males, $\rho = -0.94$, $p < 0.01$; females, $\rho = -0.96$, $p < 0.01$).

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 Southwest Michigan [5] and the State of Michigan, All Ages, 2000-2002.



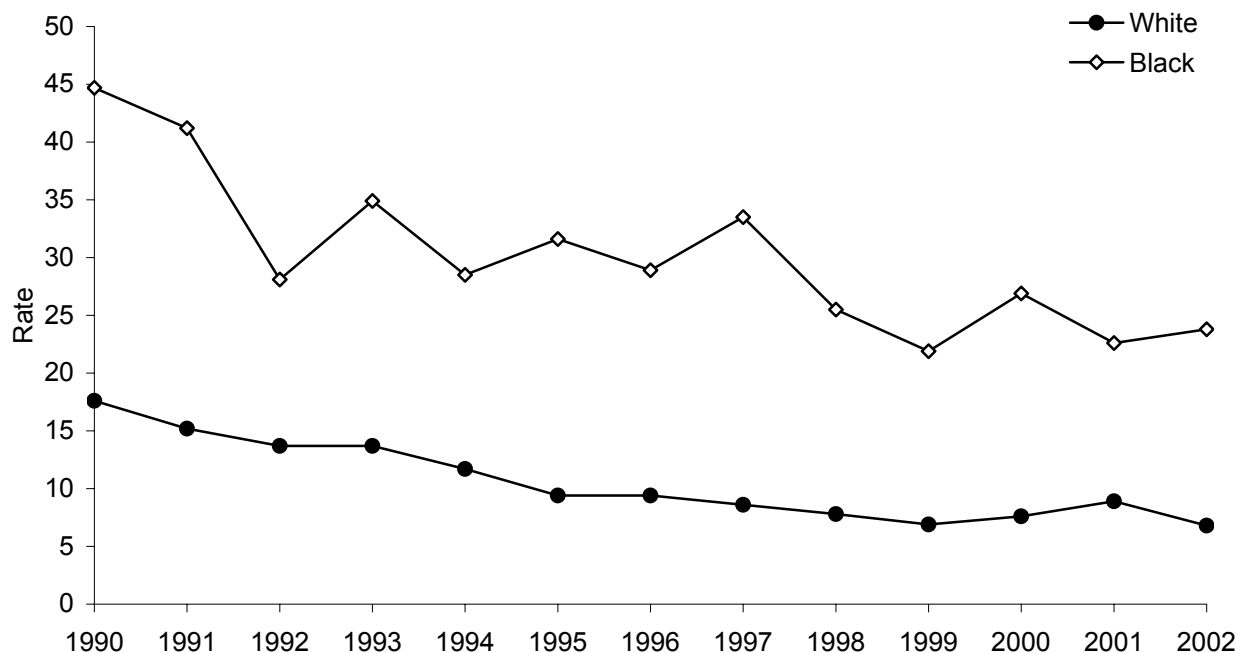
- 1 Rates are age adjusted to the 2000 US standard population by the direct standardization method. Hospitalization records with missing age are excluded.
- 2 Population estimates are taken from the Michigan population estimates for 2001.
- 3 Asthma hospitalization is defined as a primary discharge diagnosis 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 Southwest Michigan is defined by the Southwest Michigan Asthma Coalition coverage area (Berrien, Cass, VanBuren Counties).

	White	Black
Southwest MI Rate	7.8	24.6
95% CI	7.1 , 8.4	21.5 , 27.7
Count	576	268
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.

- ✧ The asthma hospitalization rates for both white persons and black persons in Southwest Michigan are significantly lower than the rates among respective groups in the State of Michigan as a whole, 2000-2002.
- ✧ The asthma hospitalization rates for white persons in Southwest Michigan and the State of Michigan are significantly lower than the rates for black persons in respective areas, 2000-2002.
- ✧ While black persons in Southwest Michigan and the State of Michigan have higher asthma hospitalization rates, 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 Southwest 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 Southwest Michigan is defined by the Southwest Michigan Asthma Coalition coverage area (Berrien, Cass, VanBuren Counties).

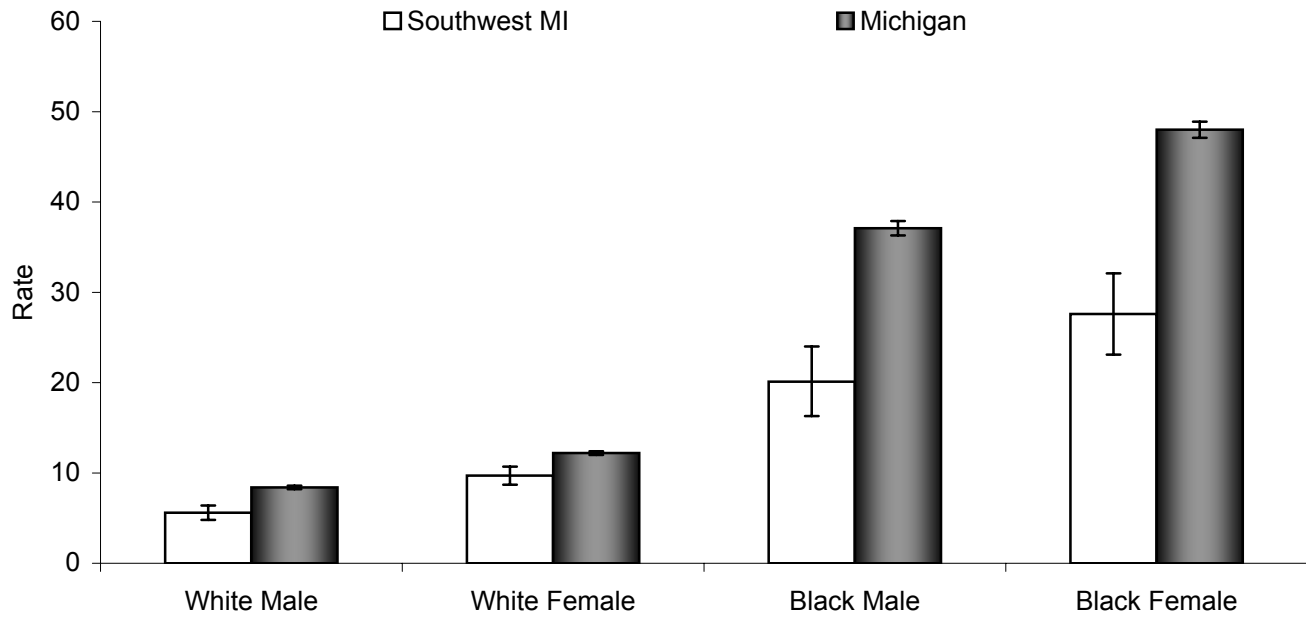
Year	White		Black	
	Rate	Count	Rate	Count
1990	17.6	441	44.7	200
1991	15.2	384	41.2	164
1992	13.7	338	28.1	123
1993	13.7	343	34.9	138
1994	11.7	290	28.5	110
1995	9.4	232	31.6	129
1996	9.4	233	28.9	123
1997	8.6	210	33.5	139
1998	7.8	189	25.5	98
1999	6.9	170	21.9	88
2000	7.6	189	26.9	105
2001	8.9	219	22.6	78
2002	6.8	168	23.8	85

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 both white persons and black persons in Southwest Michigan (whites, $\rho = -0.94$, $p < 0.01$; blacks, $\rho = -0.82$, $p < 0.01$).

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 Southwest Michigan [5] and the State of Michigan, All Ages, 2000-2002.



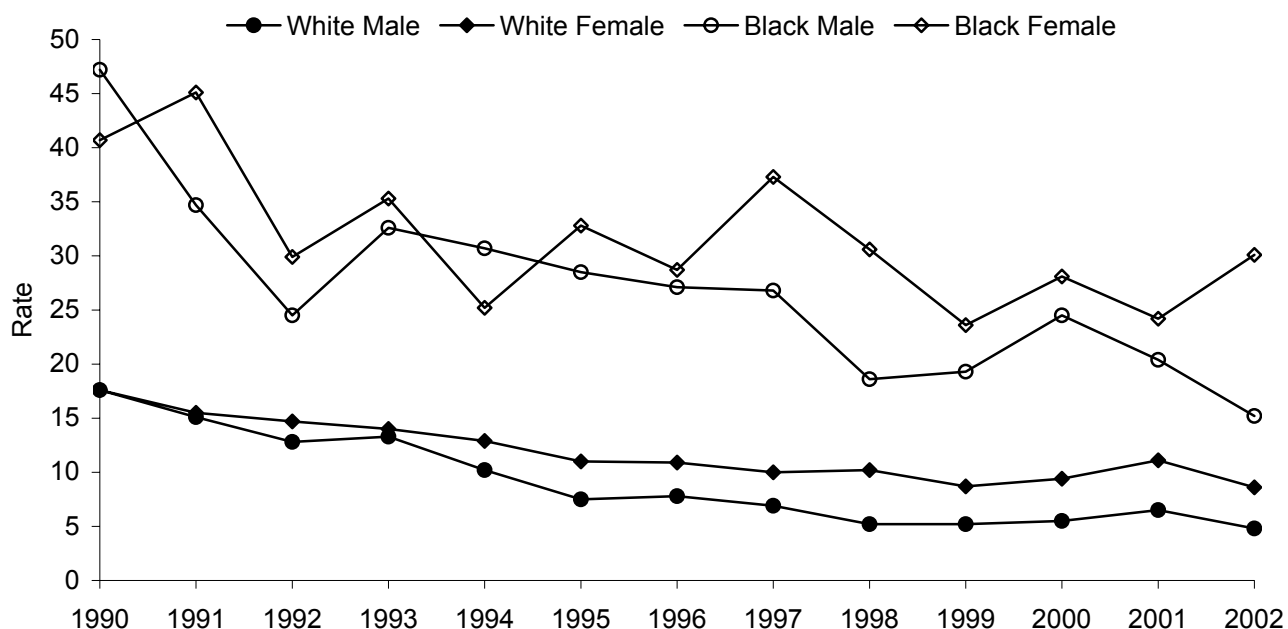
- 1 Rates are age adjusted to the 2000 US standard population by the direct standardization method. Hospitalization records with missing age are excluded.
- 2 Population estimates are taken from the Michigan population estimates for 2001.
- 3 Asthma hospitalization is defined as a primary discharge diagnosis 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 Southwest Michigan is defined by the Southwest Michigan Asthma Coalition coverage area (Berrien, Cass, VanBuren Counties).

	White Male	White Female	Black Male	Black Female
Southwest MI Rate	5.6	9.7	20.1	27.6
95% CI	4.8 , 6.4	8.7 , 10.7	16.3 , 24.0	23.1 , 32.1
Count	200	376	120	148
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.

- ✧ The asthma hospitalization rate for black females in Southwest Michigan is higher than the rates among white males, white females, or black males in Southwest Michigan, 2000-2002.
- ✧ The asthma hospitalization rate for black persons in Southwest Michigan is significantly higher than the rate among white persons in Southwest Michigan, 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 Southwest 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 Southwest Michigan is defined by the Southwest Michigan Asthma Coalition coverage area (Berrien, Cass, VanBuren Counties).

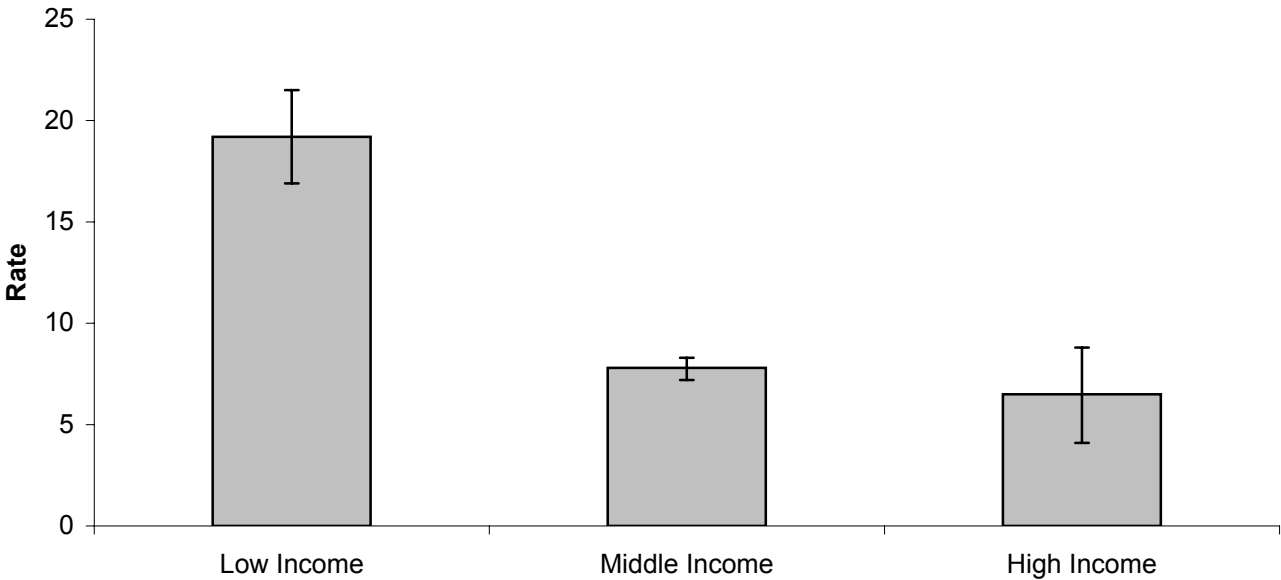
Year	White Male		White Female		Black Male		Black Female	
	Rate	Count	Rate	Count	Rate	Count	Rate	Count
1990	17.6	218	17.6	223	47.2	115	40.7	85
1991	15.1	189	15.5	195	34.7	76	45.1	88
1992	12.8	155	14.7	183	24.5	60	29.9	63
1993	13.3	163	14.0	180	32.6	71	35.3	67
1994	10.2	124	12.9	166	30.7	63	25.2	47
1995	7.5	92	11.0	140	28.5	63	32.8	66
1996	7.8	94	10.9	139	27.1	65	28.7	58
1997	6.9	83	10.0	127	26.8	66	37.3	73
1998	5.2	59	10.2	130	18.6	40	30.6	58
1999	5.2	61	8.7	109	19.3	41	23.6	47
2000	5.5	67	9.4	122	24.5	53	28.1	52
2001	6.5	76	11.1	143	20.4	36	24.2	42
2002	4.8	57	8.6	111	15.2	31	30.1	54

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 male, white female, black male, and black female populations in Southwest Michigan (white male, $\rho = -0.94$, $p < 0.01$; white female, $\rho = -0.87$, $p < 0.01$; black male, $\rho = -0.85$, $p < 0.01$; black female, $\rho = -0.59$, $p < 0.05$).

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 Southwest Michigan [5], 2000-2002.



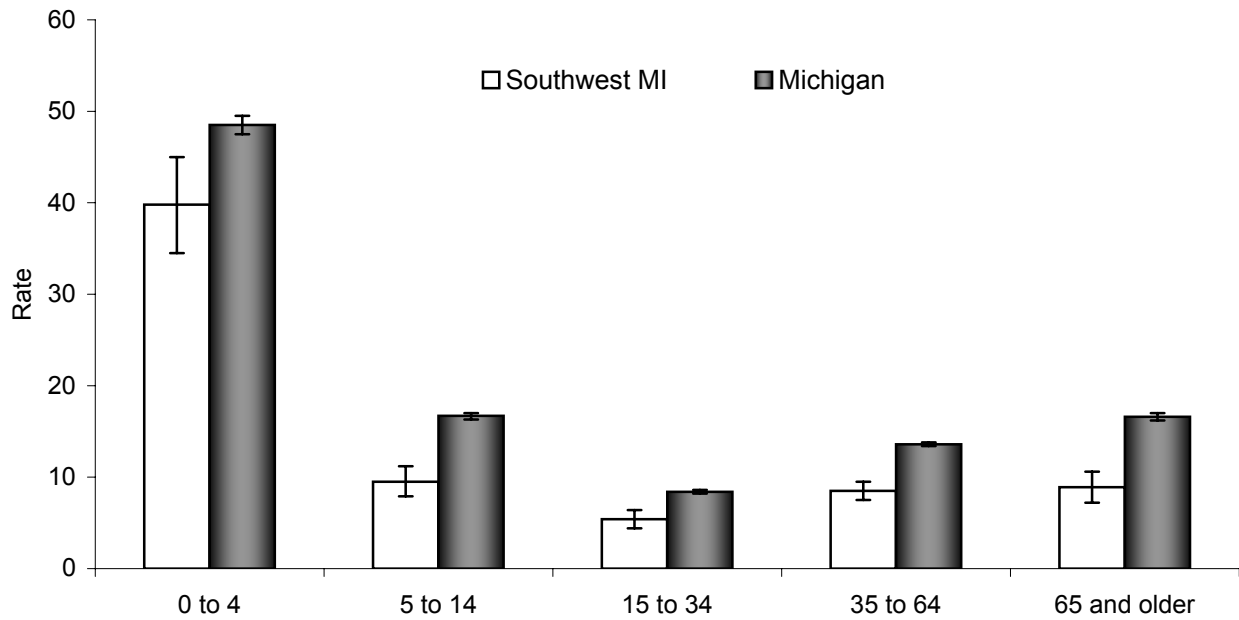
- 1 Rates are age adjusted to the 2000 US standard population by the direct standardization method. Hospitalization records with missing age are excluded.
- 2 Populations are taken from the 2000 US Census.
- 3 Asthma hospitalization is defined as a primary discharge diagnosis of asthma, ICD-9-CM=493.XX.
- 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 Southwest Michigan is defined by the Southwest Michigan Asthma Coalition coverage area (Berrien, Cass, VanBuren Counties).

	Low Income	Medium Income	High Income
Southwest MI Rate	19.2	7.8	6.5
95% CI	16.9 , 21.5	7.2 , 8.3	4.1 , 8.8
Count	270	741	30

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

✧ The asthma hospitalization rate for low income areas in Southwest Michigan is significantly higher than the rates for middle or high income areas in Southwest Michigan, 2000-2002.

Figure 10. Rates (per 10,000) [1] of Hospitalization due to Asthma [2] by Age Group for Southwest 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.

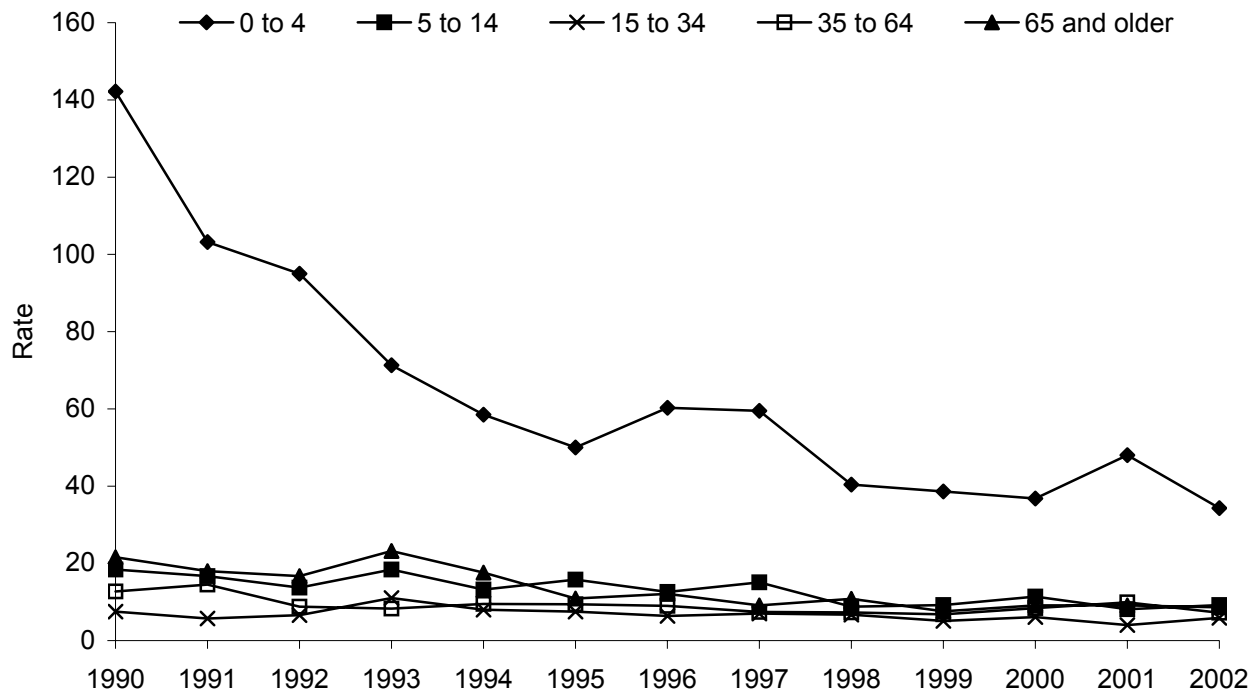
3 Southwest Michigan is defined by the Southwest Michigan Asthma Coalition coverage area (Berrien, Cass, VanBuren Counties).

	0 to 4	5 to 14	15 to 34	35 to 64	65 and older
Southwest MI Rate	39.8	9.5	5.4	8.5	8.9
95% CI	34.5 , 45.0	7.9 , 11.2	4.4 , 6.4	7.5 , 9.5	7.2 , 10.6
Count	221	124	116	298	106
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 Southwest 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 Southwest 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 Southwest 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 Southwest Michigan is defined by the Southwest Michigan Asthma Coalition coverage area (Berrien, Cass, VanBuren Counties).

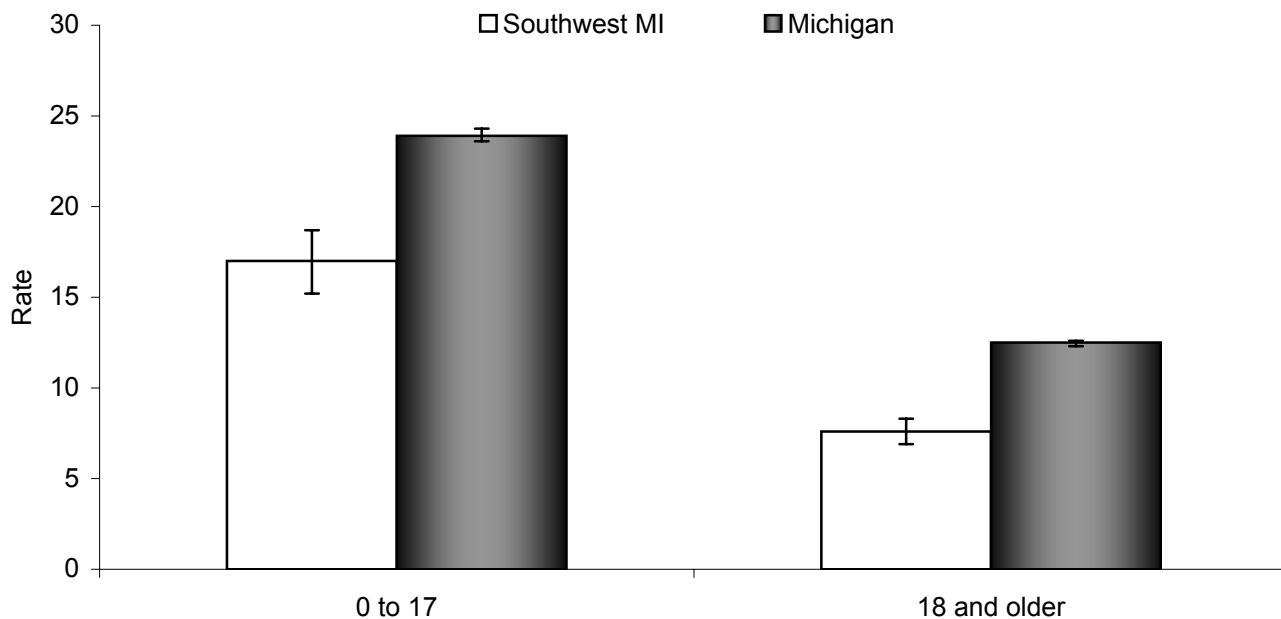
Year	0 to 4		5 to 14		15 to 34		35 to 64		65 and older	
	Rate	Count	Rate	Count	Rate	Count	Rate	Count	Rate	Count
1990	142.2	302	18.4	80	7.5	61	12.7	124	21.6	81
1991	103.2	219	16.7	73	5.7	46	14.5	144	18.0	68
1992	95.0	201	13.7	60	6.6	52	8.8	89	16.7	64
1993	71.3	150	18.4	81	11.0	85	8.3	86	23.2	90
1994	58.5	121	13.2	58	8.0	61	9.5	100	17.6	69
1995	50.0	101	15.8	70	7.5	57	9.4	101	10.9	43
1996	60.3	119	12.6	56	6.4	48	9.0	98	12.1	48
1997	59.5	115	15.1	67	7.0	52	7.4	82	9.1	36
1998	40.4	77	8.8	39	6.7	49	7.3	82	10.8	43
1999	38.6	73	9.2	41	5.1	37	6.8	78	7.6	30
2000	36.8	69	11.4	50	6.1	44	8.4	98	9.1	36
2001	48.0	89	8.1	35	4.0	29	9.9	116	9.1	36
2002	34.3	63	9.2	39	5.9	43	7.2	84	8.6	34

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 0 to 4 years, 5 to 14 years, 35 to 64 years, and 65 years and older in Southwest Michigan (0 to 4, $\rho = -0.92$, $p < 0.01$; 5 to 14, $\rho = -0.85$, $p < 0.01$; 35 to 64, $\rho = -0.58$, $p < 0.05$; 65 and older, $\rho = -0.90$, $p < 0.01$).

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 Southwest Michigan [4] and the State of Michigan, 2000-2002.



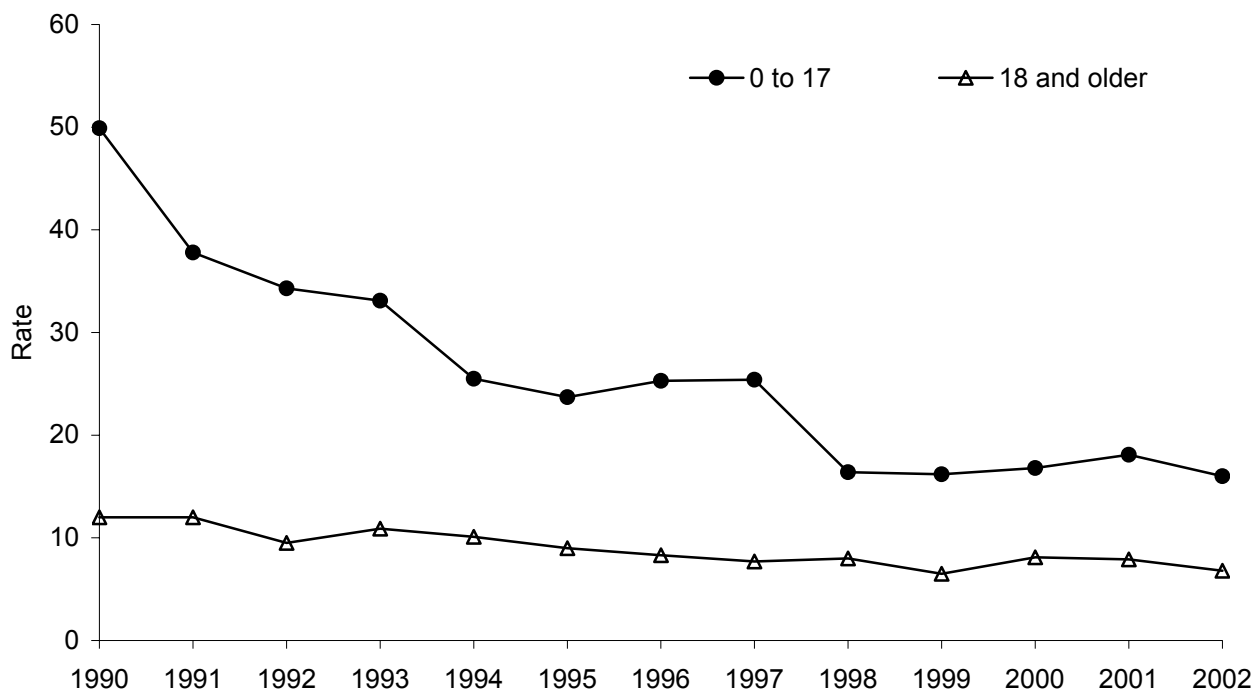
- 1 Rates are age adjusted to the 2000 US standard population by the direct standardization method. Hospitalization records with missing age are excluded.
- 2 Population estimates are taken from the Michigan population estimates for 2001.
- 3 Asthma hospitalization is defined as a primary discharge diagnosis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

	0 to 17	18 and Older
Southwest MI Rate	17.0	7.6
95% CI	15.2 , 18.7	6.9 , 8.3
Count	366	499
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 Southwest 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 Southwest 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 Southwest 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 Southwest Michigan is defined by the Southwest Michigan Asthma Coalition coverage area (Berrien, Cass, VanBuren Counties).

Year	0 to 17		18 and Older	
	Rate	Count	Rate	Count
1990	49.9	395	12.0	253
1991	37.8	297	12.0	253
1992	34.3	268	9.5	198
1993	33.1	257	10.9	235
1994	25.5	197	10.1	212
1995	23.7	182	9.0	190
1996	25.3	191	8.3	178
1997	25.4	189	7.7	163
1998	16.4	120	8.0	170
1999	16.2	119	6.5	140
2000	16.8	123	8.1	174
2001	18.1	129	7.9	176
2002	16.0	114	6.8	149

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 children aged less than 18 years and adults aged 18 years and older in Southwest Michigan (less than 18, $\rho = -0.93$, $p < 0.01$; 18 and older, $\rho = -0.89$, $p < 0.01$).

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, Southwest Michigan [4], All Ages, 2000-2002.

Zip Code	Count	Rate	95% Confidence Interval	
			Lower Limit	Upper Limit
49009	65	7.6	5.7	9.5
49010	33	6.6	4.3	8.8
49013	12	‡	‡	‡
49022	237	21.2	18.5	24.0
49026	7	‡	‡	‡
49027	~	‡	‡	‡
49031	18	‡	‡	‡
49038	23	8.1	4.8	11.4
49043	17	‡	‡	‡
49045	22	12.2	7.1	17.3
49047	76	16.4	12.7	20.1
49055	9	‡	‡	‡
49056	6	‡	‡	‡
49057	33	16.1	10.6	21.6
49061	~	‡	‡	‡
49064	9	‡	‡	‡
49065	13	‡	‡	‡
49067	8	‡	‡	‡
49071	14	‡	‡	‡
49078	14	‡	‡	‡
49079	40	10.0	6.9	13.1
49085	32	4.2	2.7	5.7
49087	12	‡	‡	‡
49090	30	7.0	4.4	9.5
49093	48	8.6	6.2	11.1
49095	~	‡	‡	‡
49098	17	‡	‡	‡
49099	9	‡	‡	‡
49101	~	‡	‡	‡
49102	~	‡	‡	‡
49103	18	‡	‡	‡
49106	7	‡	‡	‡
49107	29	9.1	5.8	12.5
49111	11	‡	‡	‡
49112	19	‡	‡	‡
49113	~	‡	‡	‡
49115	~	‡	‡	‡

Note: Table continued on next page.

(continued from previous page)

49116	~	‡	‡	‡
49117	18	‡	‡	‡
49119	~	‡	‡	‡
49120	92	8.8	7.0	10.6
49125	~	‡	‡	‡
49126	~	‡	‡	‡
49127	11	‡	‡	‡
49128	7	‡	‡	‡
49129	~	‡	‡	‡
49130	~	‡	‡	‡
Southwest MI	865	10.0	9.3	10.7

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 Southwest Michigan is defined by the Southwest Michigan Asthma Coalition coverage area (Berrien, Cass, VanBuren 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.

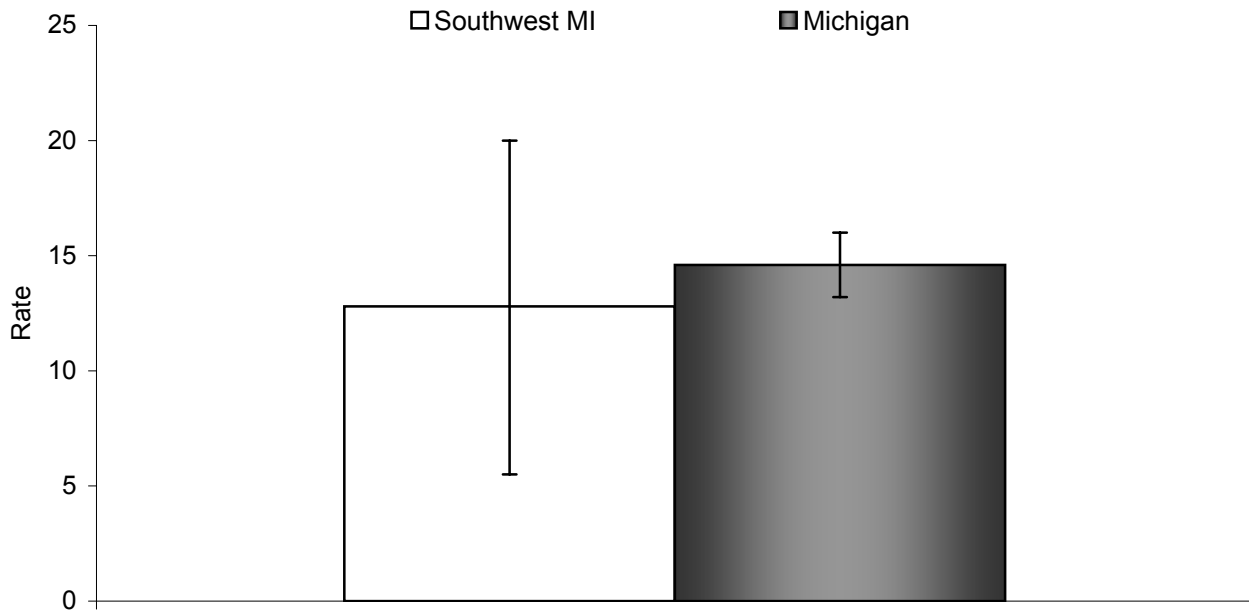
While a comparability ratio between ICD-9 and ICD-10 exists for asthma (0.8938; that is, for every 100 asthma deaths coded with ICD-9, only 89.38 would be coded as asthma using ICD-10), the analysis presented here does not attempt to compare pre-1999 data with asthma death occurring since 1999. (Anderson 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 was not conducted.

Figure 14. Rates (per 1,000,000) [1,2] of Mortality due to Asthma [3] for Southwest 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.

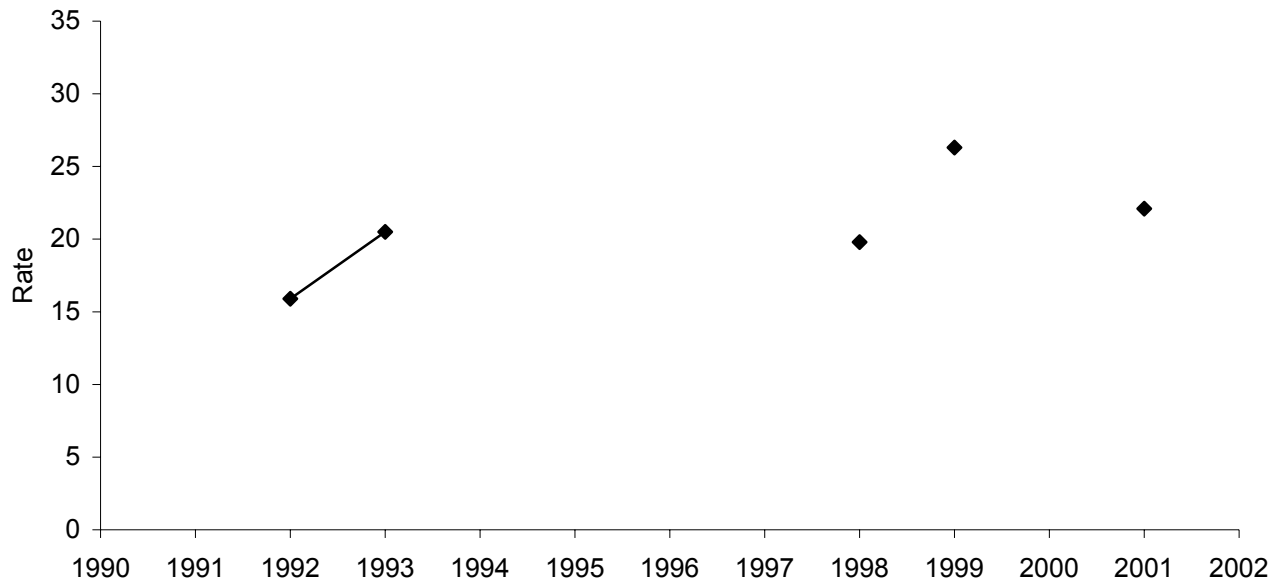
4 Southwest Michigan is defined by the Southwest Michigan Asthma Coalition coverage area (Berrien, Cass, VanBuren Counties).

	Total Population
Southwest MI Rate	12.8
95% CI	5.5 , 20.0
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 Southwest 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 Southwest 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 Southwest Michigan is defined by the Southwest Michigan Asthma Coalition coverage area (Berrien, Cass, VanBuren 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.

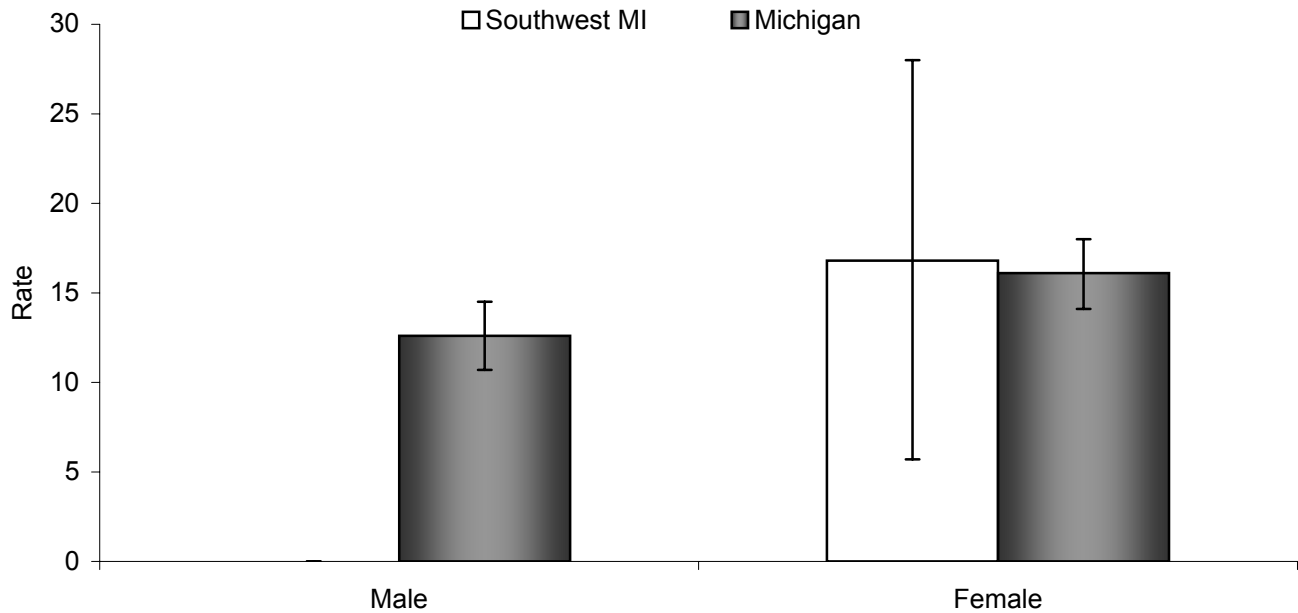
Year	Total Population	
	Rate	Count
1990	†	~
1991	†	~
1992	15.9	5
1993	20.5	6
1994	†	~
1995	†	~
1996	†	~
1997	†	~
1998	19.8	6
1999	26.3	8
2000	†	~
2001	22.1	7
2002	†	~

- † 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 Southwest 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 Southwest Michigan is defined by the Southwest Michigan Asthma Coalition coverage area (Berrien, Cass, VanBuren Counties).

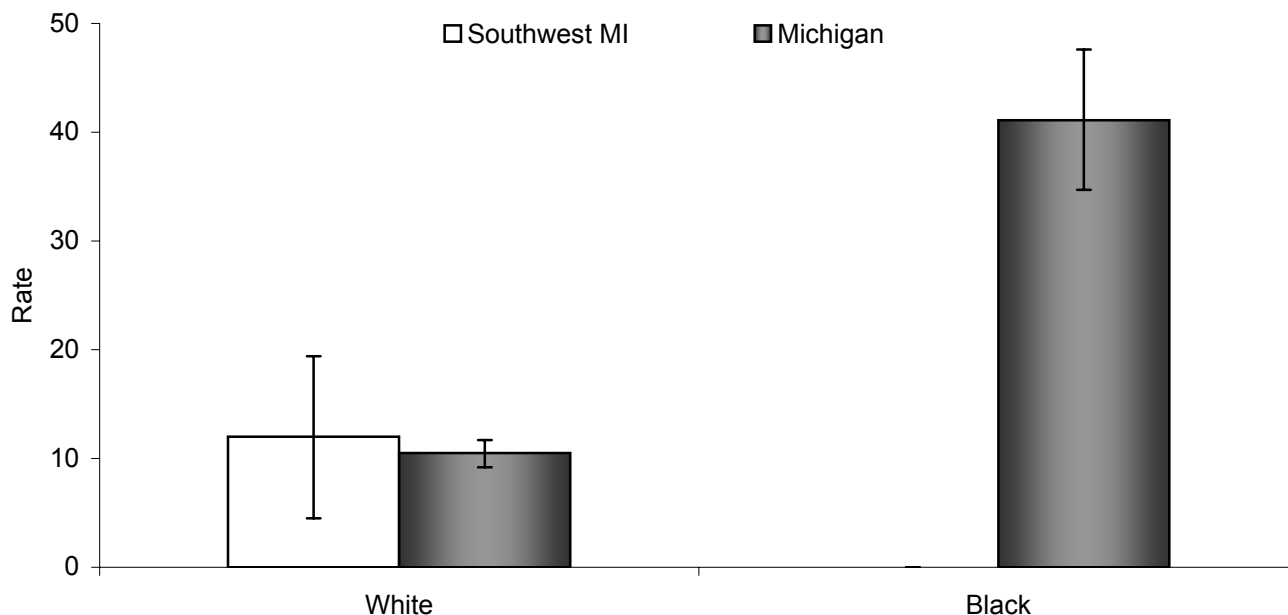
	Male	Female
Southwest MI Rate	‡	16.8
95% CI	‡ , ‡	5.7 , 28.0
Count	~	9
Michigan Rate	12.6	16.1
95% CI	10.7 , 14.5	14.1 , 18.0
Count	171	270

- ‡ 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 Southwest 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 Southwest 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 Southwest Michigan is defined by the Southwest Michigan Asthma Coalition coverage area (Berrien, Cass, VanBuren Counties).

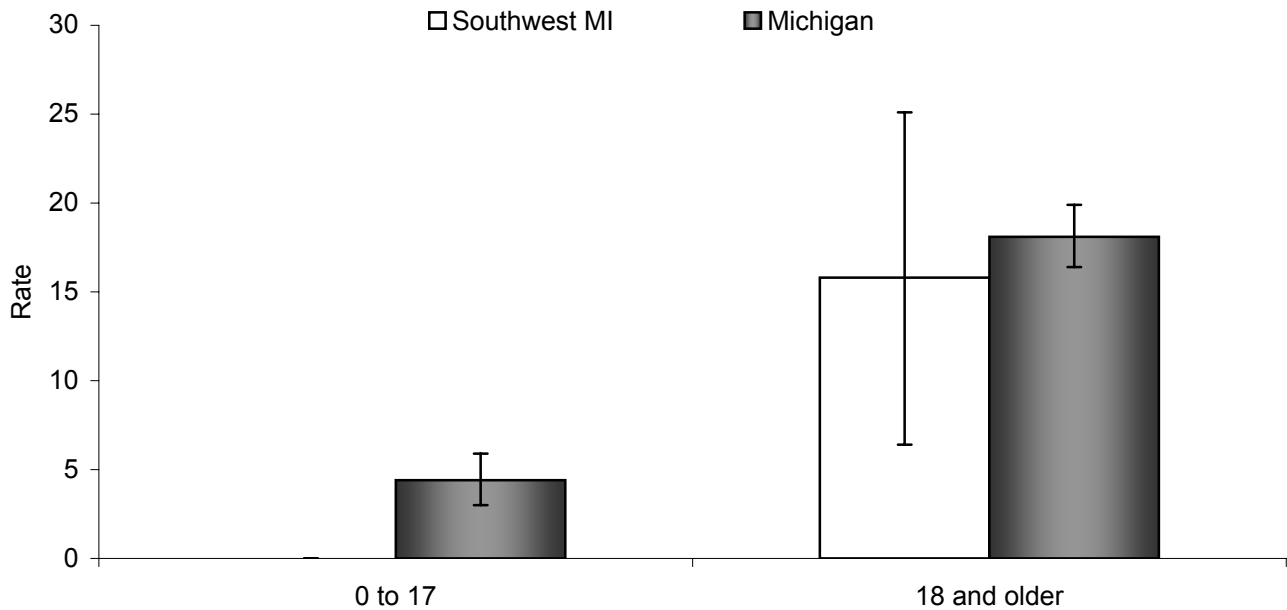
	White	Black
Southwest MI Rate	12.0	‡
95% CI	4.5 , 19.4	‡ , ‡
Count	10	~
Michigan Rate	10.5	41.1
95% CI	9.2 , 11.7	34.7 , 47.6
Count	273	163

- ‡ 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 Southwest 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 Southwest 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 Southwest Michigan is defined by the Southwest Michigan Asthma Coalition coverage area (Berrien, Cass, VanBuren Counties).

	0 to 17	18 and Older
Southwest MI Rate	‡	15.8
95% CI	‡ , ‡	6.4 , 25.1
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 individuals aged 18 years and older in Southwest Michigan is not significantly different than the respective 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 Berrien, Cass, and VanBuren Counties, Southwest 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 Southwest 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.

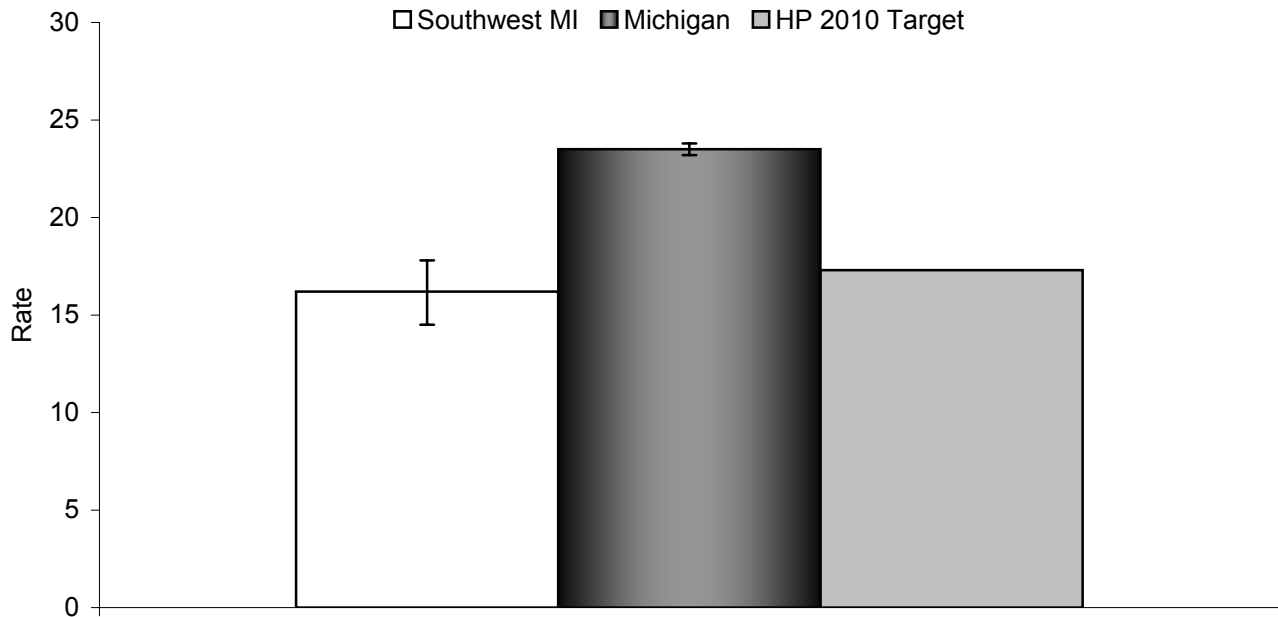
Targets: 1 per 1,000,000 (age 0-4 years)
1 per 1,000,000 (age 5-14 years)
2 per 1,000,000 (age 15-34 years)
9 per 1,000,000 (age 35-64 years)
60 per 1,000,000 (age ≥65 years)

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 Southwest Michigan [4] and the State of Michigan, 2000-2002, Compared to the Healthy People 2010 Target (Objective 1-9a).



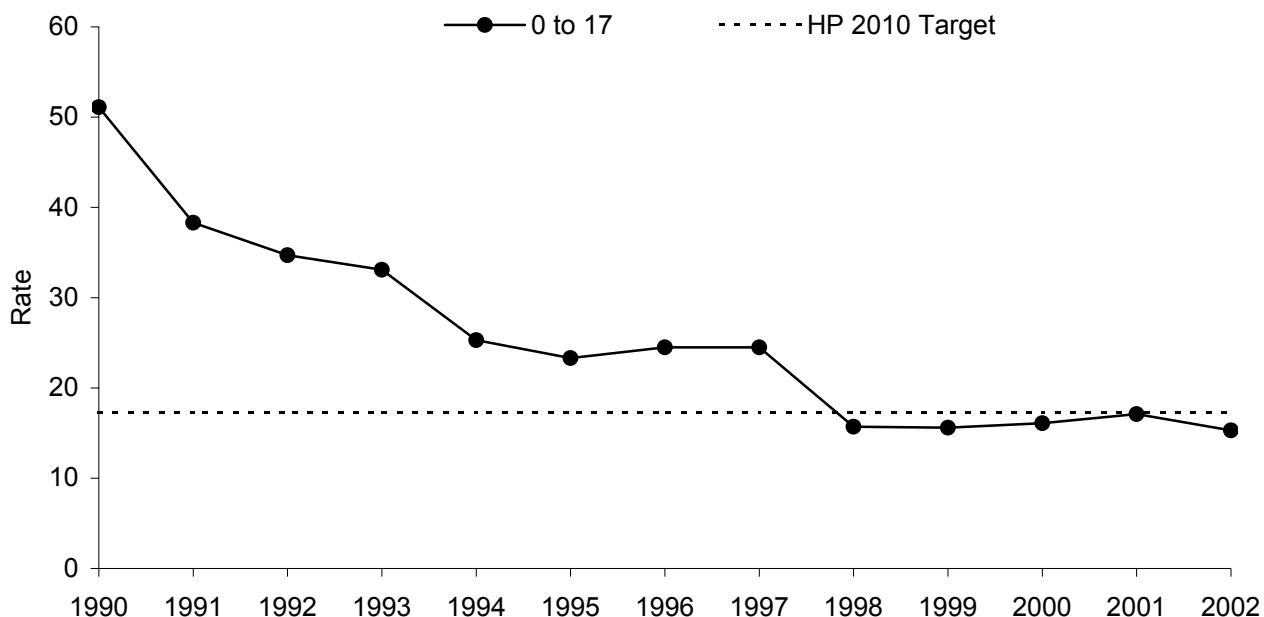
- 1 Population estimates are taken from the Michigan population estimates for 2001.
- 2 Not age adjusted in accordance with analysis prescribed by Healthy People 2010 Objectives.
- 3 Asthma hospitalization is defined as a primary discharge diagnosis of asthma, ICD-9-CM=493.XX.
- 4 Southwest Michigan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

	Total Population
Southwest MI Rate	16.2
95% CI	14.5 , 17.8
Count	366
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 Southwest Michigan, 2000-2002, is 122.
- ✧ The rate of asthma hospitalization for children aged less than 18 years in Southwest Michigan, 2000-2002, is not significantly different 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 Southwest 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 Southwest Michigan is defined by the Southwest Michigan Asthma Coalition coverage area (Berrien, Cass, VanBuren Counties).

Year	0 to 17	
	Rate	Count
1990	51.1	395
1991	38.3	297
1992	34.7	268
1993	33.1	257
1994	25.3	197
1995	23.3	182
1996	24.5	191
1997	24.5	189
1998	15.7	120
1999	15.6	119
2000	16.1	123
2001	17.1	129
2002	15.3	114

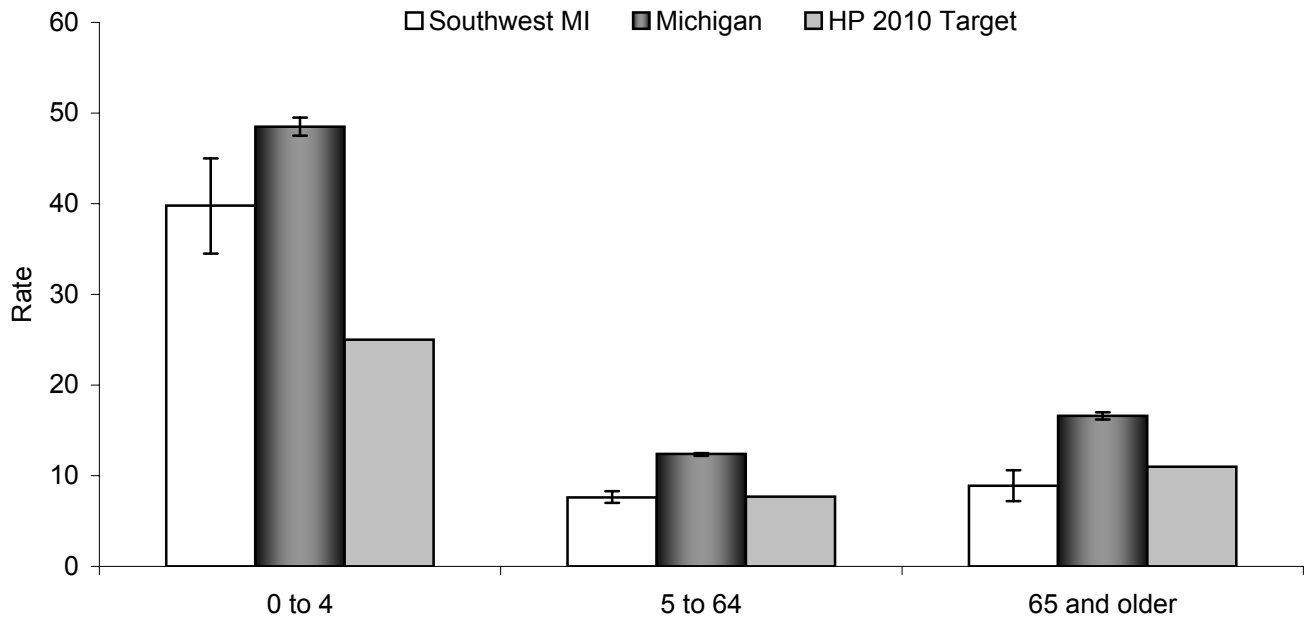
HP 2010 Target	17.3
-----------------------	-------------

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 less than 18 years in Southwest Michigan ($\rho = -0.93$, $p < 0.01$).

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 Southwest Michigan [4] and the State of Michigan, 2000-2002, Compared to the Healthy People 2010 Targets (Objective 24-2).



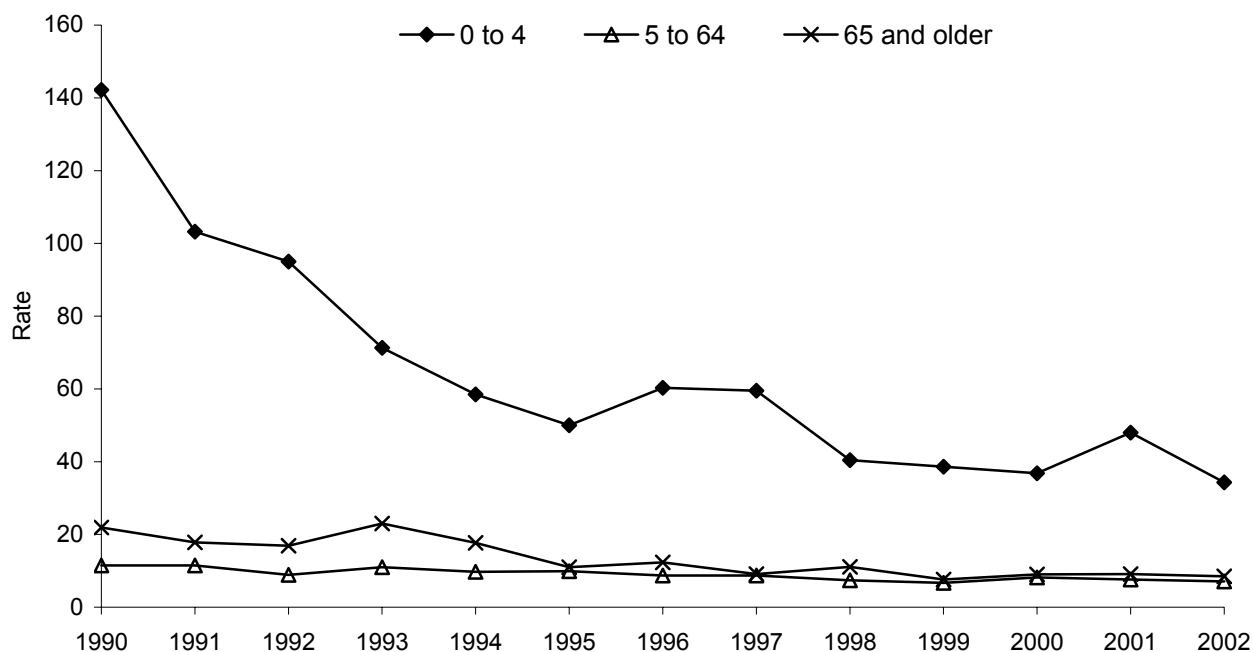
- 1 For age group 5-64 years and age group 65 and older, rates are age adjusted to the 2000 US standard population by the direct standardization method. Hospitalization records with missing age are excluded.
- 2 Population estimates are taken from the Michigan population estimates for 2001.
- 3 Asthma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

	0 to 4	5 to 64	65 and Older
Southwest MI Rate	39.8	7.6	8.9
95% CI	34.5 , 45.0	7.0 , 8.3	7.2 , 10.6
Count	221	538	106
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 Southwest Michigan is significantly lower than the *Healthy People 2010* Target Rate for persons aged 65 years and older, 2000-2002.
- ✧ The rate of asthma hospitalization in Southwest Michigan is significantly higher than the *Healthy People 2010* Target Rate for persons aged 0 to 4 years, 2000-2002.
- ✧ For all age groups, the rates of asthma hospitalization in Southwest Michigan are significantly lower than the respective rates for the State of Michigan as a whole, 2000-2002.

Figure 22. Annual Rates (per 10,000) [1,2] of Asthma [3] Hospitalization by Age Group for Southwest 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 Southwest Michigan is defined by the Southwest Michigan Asthma Coalition coverage area (Berrien, Cass, VanBuren Counties).

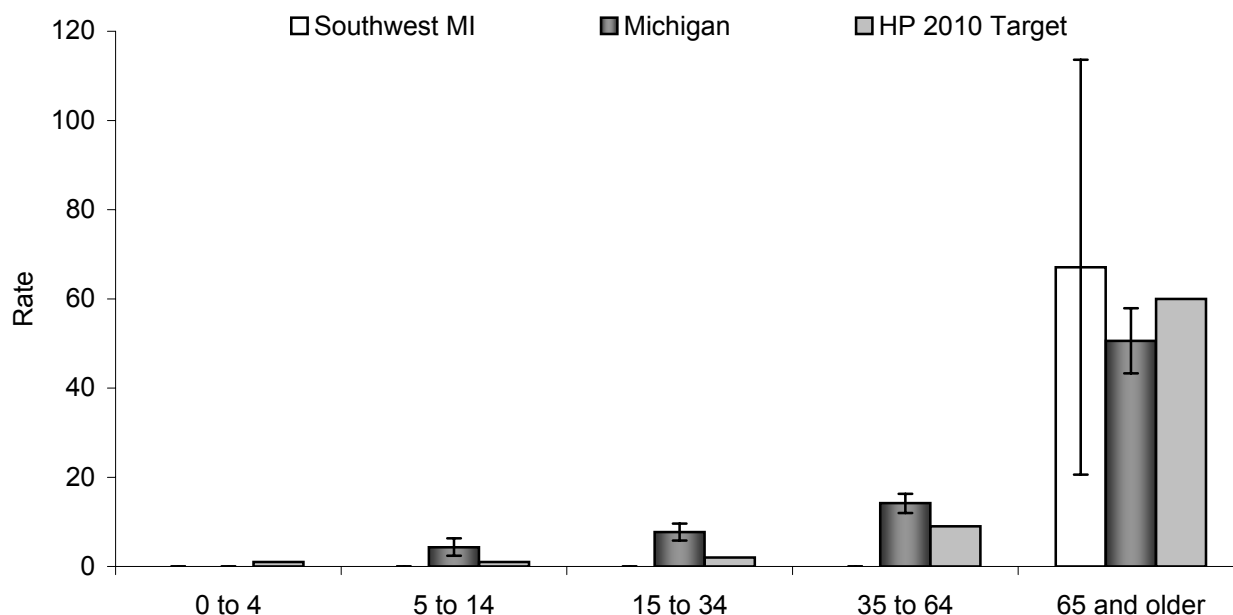
Year	0 to 4		5 to 64		65 and Older	
	Rate	Count	Rate	Count	Rate	Count
1990	142.2	302	11.5	265	21.9	81
1991	103.2	219	11.5	263	17.8	68
1992	95.0	201	8.9	201	16.9	64
1993	71.3	150	11.0	252	23.0	90
1994	58.5	121	9.7	219	17.7	69
1995	50.0	101	9.9	228	11.0	43
1996	60.3	119	8.7	202	12.3	48
1997	59.5	115	8.7	201	9.1	36
1998	40.4	77	7.4	170	11.1	43
1999	38.6	73	6.7	156	7.6	30
2000	36.8	69	8.2	192	9.0	36
2001	48.0	89	7.6	180	9.1	36
2002	34.3	63	7.1	166	8.5	34
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 0 to 4 years, 5 to 64 years, and 65 years and older in Southwest Michigan (0 to 4 years, $\rho = -0.92$, $p < 0.01$; 5 to 64 years, $\rho = -0.90$, $p < 0.01$; 65 years and older, $\rho = -0.88$, $p < 0.01$).

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 Southwest 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 Southwest Michigan is defined by the Southwest Michigan Asthma Coalition coverage area (Berrien, Cass, VanBuren Counties).

	0 to 4	5 to 14	15 to 34	35 to 64	65 and Older
Southwest MI Rate	‡	‡	‡	‡	67.1
95% CI	‡, ‡	‡, ‡	‡, ‡	‡, ‡	20.6, 113.6
Count	~	~	~	~	8
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 Berrien, Cass, and VanBuren Counties, Southwest Michigan, and the State of Michigan. It also includes a summary for each Southwest 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 Berrien, Cass, and VanBuren Counties, Southwest Michigan [5], and the State of Michigan, 1990-2002.

Year	Berrien		Cass		VanBuren		Southwest MI		Michigan	
	Rate	Count	Rate	Count	Rate	Count	Rate	Count	Rate	Count
1990	24.1	416	22.5	112	16.5	120	21.8	648	19.1	17,790
1991	20.2	344	22.5	113	12.6	93	18.6	550	18.1	16,995
1992	16.5	278	18.6	93	12.9	95	15.9	466	18.4	17,597
1993	18.1	304	19.7	98	11.9	90	16.7	492	19.8	18,975
1994	14.3	236	12.8	64	14.6	109	14.1	409	18.4	17,609
1995	14.9	245	11.3	56	9.6	71	12.8	372	19.5	18,945
1996	13.6	222	12.2	61	11.4	86	12.8	369	18.5	18,058
1997	15.4	249	8.9	45	7.7	58	12.3	352	17.7	17,320
1998	11.3	182	8.2	40	9.2	68	10.2	290	15.6	15,289
1999	9.3	149	9.6	49	8.1	61	9.0	259	15.6	15,385
2000	10.9	175	10.6	54	8.9	68	10.3	297	16.0	15,886
2001	9.7	157	11.0	56	11.9	92	10.5	305	15.5	15,363
2002	10.4	168	7.5	36	7.7	59	9.2	263	14.7	14,696

Spearman's ρ	-0.92**	-0.88**	-0.77**	-0.93**	-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 Southwest Michigan is defined by the Southwest Michigan Asthma Coalition coverage area (Berrien, Cass, VanBuren 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 Berrien, Cass, and VanBuren Counties, Southwest Michigan [5],
and the State of Michigan, 1990-2002.**

Year	Berrien		Cass		VanBuren		Southwest MI		Michigan	
	Rate	Count	Rate	Count	Rate	Count	Rate	Count	Rate	Count
1990	25.1	217	23.3	57	16.5	62	22.5	336	17.1	7,951
1991	18.8	161	22.4	55	13.3	50	18.0	266	15.7	7,345
1992	14.3	121	21.0	53	11.8	44	14.8	218	16.1	7,666
1993	17.3	144	20.6	51	12.2	48	16.5	243	16.6	7,929
1994	14.0	116	14.6	36	11.1	41	13.4	193	15.4	7,339
1995	13.4	111	8.6	22	7.1	27	10.9	160	17.1	8,275
1996	13.1	107	11.0	27	8.1	32	11.5	166	15.9	7,725
1997	13.1	108	‡	19	6.6	25	10.4	152	15.4	7,546
1998	8.3	66	‡	14	6.0	21	7.2	101	12.7	6,199
1999	7.5	60	‡	18	6.3	25	7.3	103	12.7	6,229
2000	9.9	80	‡	16	6.7	26	8.5	122	13.7	6,745
2001	7.6	60	8.7	21	9.7	38	8.4	119	12.8	6,271
2002	8.2	65	‡	13	‡	16	6.6	94	12.2	5,971

Spearman's ρ	-0.94**	ψ	ψ	-0.94**	-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 Southwest Michigan is defined by the Southwest Michigan Asthma Coalition coverage area (Berrien, Cass, VanBuren 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 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 Berrien, Cass, and VanBuren Counties, Southwest Michigan [5], and the State of Michigan, 1990-2002.

Year	Berrien		Cass		VanBuren		Southwest MI		Michigan	
	Rate	Count	Rate	Count	Rate	Count	Rate	Count	Rate	Count
1990	23.0	199	21.4	55	16.0	58	20.9	312	20.6	9,834
1991	21.3	183	23.5	58	11.8	43	19.2	284	20.0	9,648
1992	18.5	157	15.9	40	13.9	51	16.8	248	20.3	9,927
1993	18.7	160	18.4	47	11.1	42	16.6	249	22.6	11,043
1994	14.1	120	10.9	28	18.1	68	14.6	216	20.9	10,269
1995	15.9	134	13.6	34	11.9	44	14.4	212	21.6	10,668
1996	13.7	115	13.5	34	14.3	54	13.8	203	20.8	10,333
1997	17.1	141	10.3	26	8.7	33	13.7	200	19.6	9,774
1998	13.7	116	10.6	26	12.5	47	12.8	189	18.1	9,089
1999	11.1	89	11.9	31	9.6	36	10.7	156	18.1	9,155
2000	11.5	95	14.4	38	10.8	42	11.8	175	18.0	9,141
2001	11.5	97	13.1	35	14.1	54	12.4	186	17.8	9,092
2002	12.3	103	9.1	23	11.1	43	11.4	169	16.9	8,725

Spearman's ρ	-0.90**	-0.72**	-0.40	-0.96**	-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 Southwest Michigan is defined by the Southwest Michigan Asthma Coalition coverage area (Berrien, Cass, VanBuren 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 Berrien, Cass, and VanBuren Counties, Southwest Michigan [6], and the State of Michigan, 1990-2002.

Year	Berrien		Cass		VanBuren		Southwest MI		Michigan	
	Rate	Count	Rate	Count	Rate	Count	Rate	Count	Rate	Count
1990	18.7	254	19.6	88	14.9	99	17.6	441	15.1	11,791
1991	15.2	208	21.2	96	11.8	80	15.2	384	14.2	11,148
1992	13.4	178	17.1	77	12.4	83	13.7	338	14.1	11,165
1993	14.2	192	17.7	80	10.2	71	13.7	343	14.8	11,757
1994	12.2	163	11.6	53	10.6	74	11.7	290	13.2	10,488
1995	10.7	142	9.3	42	7.1	48	9.4	232	13.2	10,586
1996	9.7	129	9.4	43	8.8	61	9.4	233	12.6	10,140
1997	9.4	123	8.8	40	6.8	47	8.6	210	12.2	9,849
1998	7.7	101	6.5	29	8.8	59	7.8	189	10.5	8,522
1999	6.1	80	8.7	41	7.0	49	6.9	170	10.7	8,716
2000	6.8	90	9.9	46	7.4	53	7.6	189	10.8	8,781
2001	6.8	89	10.5	48	11.5	82	8.9	219	10.5	8,541
2002	6.6	87	7.0	31	7.0	50	6.8	168	9.9	8,133

Spearman's ρ	-0.96**	-0.76**	-0.66*	-0.94**	-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 Southwest Michigan is defined by the Southwest Michigan Asthma Coalition coverage area (Berrien, Cass, VanBuren 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 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 Berrien, Cass, and VanBuren Counties, Southwest
Michigan [6], and the State of Michigan, 1990-2002.**

Year	Berrien		Cass		VanBuren		Southwest MI		Michigan	
	Rate	Count	Rate	Count	Rate	Count	Rate	Count	Rate	Count
1990	43.8	160	‡	23	‡	17	44.7	200	43.0	5,800
1991	45.7	136	‡	17	‡	11	41.2	164	41.4	5,715
1992	30.9	99	‡	16	‡	8	28.1	123	44.4	6,209
1993	34.2	106	‡	18	‡	14	34.9	138	49.1	6,948
1994	22.3	71	‡	11	‡	28	28.5	110	48.5	6,858
1995	30.6	101	‡	9	‡	19	31.6	129	54.0	8,031
1996	25.3	88	‡	15	‡	20	28.9	123	51.3	7,603
1997	38.5	125	‡	5	‡	9	33.5	139	48.0	7,246
1998	27.5	79	‡	11	‡	8	25.5	98	45.3	6,607
1999	21.4	69	‡	8	‡	11	21.9	88	44.2	6,459
2000	27.1	84	‡	7	‡	14	26.9	105	45.2	6,888
2001	23.6	64	‡	8	‡	6	22.6	78	43.2	6,518
2002	26.0	71	‡	5	‡	9	23.8	85	42.0	6,279

Spearman's ρ	-0.65*	‡	‡	-0.82**	-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 Southwest Michigan is defined by the Southwest Michigan Asthma Coalition coverage area (Berrien, Cass, VanBuren Counties).

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

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

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

‡ 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 Berrien, Cass, and VanBuren Counties, Southwest Michigan [6], and the State of Michigan, 1990-2002.

Year	Berrien		Cass		VanBuren		Southwest MI		Michigan	
	Rate	Count	Rate	Count	Rate	Count	Rate	Count	Rate	Count
1990	17.6	118	21.1	46	15.8	54	17.6	218	13.4	5,142
1991	14.4	97	21.8	48	12.8	44	15.1	189	12.0	4,632
1992	11.7	75	18.6	42	11.4	38	12.8	155	12.1	4,715
1993	13.0	84	18.5	41	10.5	38	13.3	163	11.9	4,633
1994	10.7	69	14.0	31	7.0	24	10.2	124	10.4	4,033
1995	8.8	57	‡	16	‡	19	7.5	92	10.9	4,285
1996	8.3	53	‡	20	5.8	21	7.8	94	10.2	4,012
1997	7.2	46	‡	16	6.1	21	6.9	83	10.1	3,993
1998	5.7	35	‡	6	‡	18	5.2	59	8.1	3,198
1999	4.3	27	‡	13	5.8	21	5.2	61	8.5	3,338
2000	6.3	40	‡	9	‡	18	5.5	67	8.9	3,499
2001	4.8	29	‡	16	8.7	31	6.5	76	8.4	3,284
2002	5.3	33	‡	10	‡	14	4.8	57	8.0	3,133

Spearman's ρ	-0.95**	ψ	ψ	-0.94**	-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 Southwest Michigan is defined by the Southwest Michigan Asthma Coalition coverage area (Berrien, Cass, VanBuren 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 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 Berrien, Cass, and VanBuren Counties,
Southwest Michigan [6], and the State of Michigan, 1990-2002.**

Year	Berrien		Cass		VanBuren		Southwest MI		Michigan	
	Rate	Count	Rate	Count	Rate	Count	Rate	Count	Rate	Count
1990	20.1	136	18.0	42	13.7	45	17.6	223	16.5	6,647
1991	15.9	111	21.5	48	10.8	36	15.5	195	16.0	6,514
1992	15.2	103	15.3	35	13.5	45	14.7	183	15.7	6,446
1993	15.5	108	16.8	39	9.5	33	14.0	180	17.3	7,122
1994	13.5	94	9.2	22	14.1	50	12.9	166	15.6	6,455
1995	12.2	85	11.3	26	8.5	29	11.0	140	15.2	6,301
1996	11.1	76	9.9	23	11.4	40	10.9	139	14.8	6,128
1997	11.2	77	10.5	24	7.5	26	10.0	127	14.1	5,856
1998	9.1	66	10.1	23	11.9	41	10.2	130	12.7	5,324
1999	8.1	53	11.7	28	8.0	28	8.7	109	12.7	5,378
2000	7.3	50	15.4	37	9.6	35	9.4	122	12.5	5,282
2001	8.5	60	13.2	32	14.3	51	11.1	143	12.4	5,257
2002	7.8	54	8.8	21	9.9	36	8.6	111	11.6	5,000

Spearman's ρ	-0.96**	-0.53	-0.19	-0.87**	-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 Southwest Michigan is defined by the Southwest Michigan Asthma Coalition coverage area (Berrien, Cass, VanBuren Counties).

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

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 Berrien, Cass, and VanBuren Counties, Southwest Michigan [6], and the State of Michigan, 1990-2002.

Year	Berrien		Cass		VanBuren		Southwest MI		Michigan	
	Rate	Count	Rate	Count	Rate	Count	Rate	Count	Rate	Count
1990	48.9	97	‡	10	‡	8	47.2	115	39.2	2,721
1991	37.5	64	‡	7	‡	5	34.7	76	36.6	2,660
1992	25.7	46	‡	~	‡	~	24.5	60	39.0	2,864
1993	29.7	54	‡	10	‡	7	32.6	71	42.8	3,169
1994	26.1	45	‡	5	‡	13	30.7	63	43.1	3,176
1995	29.0	53	‡	~	‡	~	28.5	63	48.6	3,838
1996	26.1	52	‡	~	‡	~	27.1	65	45.8	3,569
1997	30.8	61	‡	~	‡	~	26.8	66	43.7	3,452
1998	17.3	30	‡	~	‡	~	18.6	40	38.3	2,927
1999	19.7	33	‡	~	‡	~	19.3	41	37.0	2,796
2000	22.7	40	‡	6	‡	7	24.5	53	39.4	3,147
2001	19.8	28	‡	~	‡	~	20.4	36	36.6	2,856
2002	15.4	26	‡	~	‡	~	15.2	31	35.0	2,699

Spearman's ρ	-0.80**		ψ		ψ		-0.85**		-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 Southwest Michigan is defined by the Southwest Michigan Asthma Coalition coverage area (Berrien, Cass, VanBuren 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 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 Berrien, Cass, and VanBuren Counties,
Southwest Michigan [6], and the State of Michigan, 1990-2002.**

Year	Berrien		Cass		VanBuren		Southwest MI		Michigan	
	Rate	Count	Rate	Count	Rate	Count	Rate	Count	Rate	Count
1990	37.4	63	‡	13	‡	9	40.7	85	45.3	3,079
1991	50.4	72	‡	10	‡	6	45.1	88	44.3	3,055
1992	33.9	53	‡	5	‡	5	29.9	63	47.8	3,345
1993	36.0	52	‡	8	‡	7	35.3	67	53.4	3,779
1994	17.6	26	‡	6	‡	15	25.2	47	51.9	3,682
1995	30.3	48	‡	5	‡	13	32.8	66	57.1	4,193
1996	22.6	36	‡	11	‡	11	28.7	58	54.7	4,034
1997	42.4	64	‡	~	‡	~	37.3	73	50.6	3,794
1998	34.8	49	‡	~	‡	~	30.6	58	50.0	3,680
1999	22.5	36	‡	~	‡	~	23.6	47	49.4	3,663
2000	29.7	44	‡	~	‡	~	28.1	52	49.0	3,741
2001	26.3	36	‡	~	‡	~	24.2	42	48.0	3,662
2002	33.1	45	‡	~	‡	~	30.1	54	47.0	3,580

Spearman's ρ	-0.46	Ψ	Ψ	-0.59*	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 Southwest Michigan is defined by the Southwest Michigan Asthma Coalition coverage area (Berrien, Cass, VanBuren 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 Berrien, Cass, and VanBuren Counties, Southwest Michigan [5], and the State of Michigan, 1990-2002.

Year	Berrien		Cass		VanBuren		Southwest MI		Michigan	
	Rate	Count	Rate	Count	Rate	Count	Rate	Count	Rate	Count
1990	181.2	220	‡	40	75.9	42	142.2	302	66.1	4,712
1991	115.1	140	‡	50	52.2	29	103.2	219	57.1	4,106
1992	105.4	128	‡	44	52.1	29	95.0	201	64.4	4,638
1993	77.9	94	‡	30	46.7	26	71.3	150	59.6	4,291
1994	63.4	75	‡	15	56.4	31	58.5	121	53.2	3,783
1995	62.5	72	‡	13	‡	16	50.0	101	63.9	4,457
1996	72.4	81	‡	10	52.6	28	60.3	119	59.6	4,092
1997	74.9	82	‡	13	‡	20	59.5	115	59.2	4,019
1998	49.3	53	‡	7	‡	17	40.4	77	40.5	2,734
1999	48.0	51	‡	9	‡	13	38.6	73	40.6	2,725
2000	40.9	43	‡	13	‡	13	36.8	69	48.8	3,257
2001	44.1	46	‡	10	64.2	33	48.0	89	50.5	3,341
2002	43.3	45	‡	8	‡	10	34.3	63	45.8	3,039

Spearman's ρ	-0.93**	‡	‡	-0.92**	-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 Southwest Michigan is defined by the Southwest Michigan Asthma Coalition coverage area (Berrien, Cass, VanBuren Counties).

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

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

‡ 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 Berrien, Cass, and VanBuren Counties, Southwest Michigan [5], and the State of Michigan, 1990-2002.

Year	Berrien		Cass		VanBuren		Southwest MI		Michigan	
	Rate	Count	Rate	Count	Rate	Count	Rate	Count	Rate	Count
1990	26.9	65	‡	5	‡	10	18.4	80	20.9	2,826
1991	20.6	50	‡	11	‡	12	16.7	73	19.4	2,666
1992	14.0	34	‡	9	‡	17	13.7	60	18.5	2,571
1993	20.1	49	‡	14	‡	18	18.4	81	21.1	2,972
1994	11.9	29	‡	13	‡	16	13.2	58	17.1	2,418
1995	20.4	50	‡	9	‡	11	15.8	70	21.9	3,152
1996	13.0	32	‡	15	‡	9	12.6	56	21.4	3,113
1997	19.6	48	‡	10	‡	9	15.1	67	22.1	3,244
1998	9.8	24	‡	8	‡	7	8.8	39	16.8	2,491
1999	10.6	26	‡	6	‡	9	9.2	41	16.8	2,497
2000	14.1	34	‡	7	‡	9	11.4	50	20.4	3,010
2001	‡	16	‡	6	‡	13	8.1	35	16.0	2,363
2002	11.5	27	‡	5	‡	7	9.2	39	13.7	2,002

Spearman's ρ	‡	‡	‡	‡	-0.85**	-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 Southwest Michigan is defined by the Southwest Michigan Asthma Coalition coverage area (Berrien, Cass, VanBuren Counties).

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

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

‡ 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 Berrien, Cass, and VanBuren Counties, Southwest Michigan [5], and the State of Michigan, 1990-2002.

Year	Berrien		Cass		VanBuren		Southwest MI		Michigan	
	Rate	Count	Rate	Count	Rate	Count	Rate	Count	Rate	Count
1990	7.5	36	‡	10	‡	15	7.5	61	9.1	2,709
1991	7.3	34	‡	~	‡	~	5.7	46	8.9	2,628
1992	5.7	26	‡	13	‡	13	6.6	52	9.8	2,839
1993	11.3	51	‡	20	‡	14	11.0	85	11.7	3,352
1994	7.2	32	‡	12	‡	17	8.0	61	10.9	3,081
1995	7.5	33	‡	6	‡	18	7.5	57	11.8	3,341
1996	6.5	28	‡	9	‡	11	6.4	48	11.5	3,220
1997	9.0	38	‡	6	‡	8	7.0	52	10.6	2,959
1998	6.3	26	‡	6	‡	17	6.7	49	10.0	2,755
1999	‡	17	‡	9	‡	11	5.1	37	9.2	2,526
2000	6.9	28	‡	5	‡	11	6.1	44	9.2	2,502
2001	‡	14	‡	7	‡	8	4.0	29	8.2	2,253
2002	5.7	23	‡	10	‡	10	5.9	43	7.7	2,104

Spearman's ρ	ψ	ψ	ψ	ψ	-0.55	-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 Southwest Michigan is defined by the Southwest Michigan Asthma Coalition coverage area (Berrien, Cass, VanBuren 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 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 Berrien, Cass, and VanBuren Counties, Southwest Michigan [5], and the State of Michigan, 1990-2002.

Year	Berrien		Cass		VanBuren		Southwest MI		Michigan	
	Rate	Count	Rate	Count	Rate	Count	Rate	Count	Rate	Count
1990	10.9	60	15.1	27	15.2	37	12.7	124	14.8	4,694
1991	15.2	85	16.0	29	12.0	30	14.5	144	15.0	4,838
1992	9.6	55	‡	10	9.3	24	8.8	89	14.5	4,795
1993	9.7	56	‡	11	‡	19	8.3	86	15.9	5,369
1994	10.2	60	‡	12	10.3	28	9.5	100	16.0	5,509
1995	10.7	64	‡	17	‡	20	9.4	101	15.6	5,493
1996	7.9	48	‡	20	10.5	30	9.0	98	15.0	5,401
1997	9.4	58	‡	11	‡	13	7.4	82	13.8	5,065
1998	8.1	50	‡	15	‡	17	7.3	82	14.2	5,275
1999	6.5	41	‡	18	‡	19	6.8	78	14.7	5,547
2000	7.5	48	‡	20	9.8	30	8.4	98	13.6	5,264
2001	10.0	64	‡	19	10.7	33	9.9	116	13.8	5,383
2002	7.9	51	‡	10	7.4	23	7.2	84	13.5	5,317

Spearman's ρ	-0.70**	‡	‡	-0.58*	-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 Southwest Michigan is defined by the Southwest Michigan Asthma Coalition coverage area (Berrien, Cass, VanBuren Counties).

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

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

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

‡ 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 CHILDREN Aged Less Than 18 Years, for Berrien, Cass, and VanBuren Counties, Southwest Michigan [5], and the State of Michigan, 1990-2002.

Year	Berrien		Cass		VanBuren		Southwest MI		Michigan	
	Rate	Count	Rate	Count	Rate	Count	Rate	Count	Rate	Count
1990	64.6	292	35.4	47	27.2	56	49.9	395	31.7	8,063
1991	43.6	195	46.6	61	19.7	41	37.8	297	28.3	7,254
1992	37.0	165	43.2	55	23.1	48	34.3	268	29.9	7,735
1993	37.1	163	37.3	48	22.1	46	33.1	257	30.5	7,875
1994	26.9	118	23.7	30	23.6	49	25.5	197	26.2	6,757
1995	30.5	132	17.4	22	13.5	28	23.7	182	31.9	8,221
1996	30.0	127	20.4	26	18.7	38	25.3	191	30.2	7,769
1997	32.1	134	20.0	25	14.9	30	25.4	189	30.1	7,742
1998	19.1	78	‡	16	12.9	26	16.4	120	21.8	5,594
1999	19.6	80	‡	16	11.3	23	16.2	119	21.6	5,546
2000	19.6	80	‡	20	11.4	23	16.8	123	26.3	6,693
2001	16.4	65	‡	17	23.7	47	18.1	129	24.1	6,089
2002	19.9	79	‡	17	‡	18	16.0	114	21.3	5,359

Spearman's ρ	-0.87**	ψ	ψ	-0.93**	-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 Southwest Michigan is defined by the Southwest Michigan Asthma Coalition coverage area (Berrien, Cass, VanBuren Counties).

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

* 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 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 Berrien, Cass, and VanBuren Counties, Southwest Michigan [5], and the State of Michigan, 1990-2002.

Year	Berrien		Cass		VanBuren		Southwest MI		Michigan	
	Rate	Count	Rate	Count	Rate	Count	Rate	Count	Rate	Count
1990	10.0	124	18.0	65	12.7	64	12.0	253	14.7	9,727
1991	12.1	149	14.1	52	10.1	52	12.0	253	14.5	9,741
1992	9.4	113	10.1	38	9.4	47	9.5	198	14.5	9,862
1993	11.4	141	13.5	50	8.3	44	10.9	235	16.1	11,100
1994	9.8	118	9.1	34	11.5	60	10.1	212	15.7	10,852
1995	9.4	113	9.1	34	8.3	43	9.0	190	15.2	10,724
1996	7.8	95	9.4	35	8.8	48	8.3	178	14.5	10,289
1997	9.6	115	‡	20	5.2	28	7.7	163	13.3	9,578
1998	8.6	104	6.6	24	8.0	42	8.0	170	13.4	9,695
1999	5.7	69	8.4	33	7.0	38	6.5	140	13.5	9,839
2000	7.8	95	8.7	34	8.1	45	8.1	174	12.5	9,193
2001	7.3	92	9.9	39	7.8	45	7.9	176	12.5	9,274
2002	7.2	89	‡	19	7.2	41	6.8	149	12.5	9,337

Spearman's ρ	-0.86**	ψ	-0.81**	-0.89**	-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 Southwest Michigan is defined by the Southwest Michigan Asthma Coalition coverage area (Berrien, Cass, VanBuren 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 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.

Berrien County

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

		Count	Rate	95% Confidence Interval	
				Lower Limit	Upper Limit
Total Population		500	10.4	9.4	11.3
Sex	Male	205	8.6	7.4	9.8
	Female	295	11.8	10.4	13.1
Race ⁵	White	266	6.8	5.9	7.6
	Black	219	25.7	22.1	29.3
Sex and Race ⁵	White Male	102	5.5	4.4	6.5
	White Female	164	7.9	6.6	9.1
	Black Male	94	19.4	15.2	23.6
	Black Female	125	29.9	24.5	35.2
Age (unadjusted)	0-4 Years	134	42.8	35.5	50.0
	5-14 Years	77	10.8	8.4	13.2
	15-34 Years	65	5.4	4.1	6.7
	35-64 Years	163	8.5	7.2	9.8
	65+ Years	61	8.7	6.5	10.9
Age	<18 Years	224	18.6	16.2	21.1
	18+ Years	276	7.5	6.6	8.4

For comparison, State of Michigan and Southwest 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 Berrien County, 2000-2002, Comparable to the Healthy People 2010 Targets.

		Count	Rate	95% Confidence Interval	
				Lower Limit	Upper Limit
Age	0-4 Years ⁶	134	42.8	35.5	50.0
	5-64 Years	305	7.8	7.0	8.7
	65+ Years	61	8.6	6.4	10.8
	<18 Years ⁶	224	18.0	15.6	20.3

For comparison, State of Michigan and Southwest 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.

Cass County

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

		Count	Rate	95% Confidence Interval	
				Lower Limit	Upper Limit
Total Population		146	9.8	8.2	11.4
Sex	Male	50	7.2	5.2	9.2
	Female	96	12.3	9.8	14.7
Race ⁵	White	125	9.2	7.5	10.8
	Black	20	‡	‡	‡
Sex and Race ⁵	White Male	35	5.7	3.8	7.6
	White Female	90	12.6	9.9	15.2
	Black Male	14	‡	‡	‡
	Black Female	6	‡	‡	‡
Age (unadjusted)	0-4 Years	31	35.0	22.7	47.4
	5-14 Years	18	‡	‡	‡
	15-34 Years	22	6.0	3.5	8.5
	35-64 Years	49	7.5	5.4	9.6
	65+ Years	26	12.5	7.7	17.3
Age	<18 Years	54	15.3	11.2	19.4
	18+ Years	92	7.9	6.2	9.5

For comparison, State of Michigan and Southwest 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 Cass County, 2000-2002, Comparable to the Healthy People 2010 Targets.

		Count	Rate	95% Confidence Interval	
				Lower Limit	Upper Limit
Age	0-4 Years ⁶	31	35.0	22.7	47.4
	5-64 Years	89	7.1	5.6	8.6
	65+ Years	26	12.7	7.8	17.5
	<18 Years ⁶	54	14.1	10.3	17.8

For comparison, State of Michigan and Southwest 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).

VanBuren County

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

		Count	Rate	95% Confidence Interval	
				Lower Limit	Upper Limit
Total Population		219	9.5	8.2	10.8
Sex	Male	80	6.8	5.3	8.3
	Female	139	12.0	10.0	14.0
Race ⁵	White	185	8.6	7.4	9.9
	Black	29	24.8	15.4	34.3
Sex and Race ⁵	White Male	63	5.8	4.4	7.3
	White Female	122	11.3	9.3	13.3
	Black Male	12	‡	‡	‡
	Black Female	17	‡	‡	‡
Age (unadjusted)	0-4 Years	56	36.3	26.8	45.8
	5-14 Years	29	8.0	5.1	10.9
	15-34 Years	29	5.1	3.2	6.9
	35-64 Years	86	9.3	7.3	11.2
	65+ Years	19	‡	‡	‡
Age	<18 Years	88	14.7	11.7	17.8
	18+ Years	131	7.7	6.4	9.0

For comparison, State of Michigan and Southwest 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 VanBuren County, 2000-2002, Comparable to the Healthy People 2010 Targets.

		Count	Rate	95% Confidence Interval	
				Lower Limit	Upper Limit
Age	0-4 Years ⁶	56	36.3	26.8	45.8
	5-64 Years	144	7.6	6.4	8.9
	65+ Years	19	‡	‡	‡
	<18 Years ⁶	88	13.9	11.0	16.8

For comparison, State of Michigan and Southwest 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).

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

Year	Berrien		Cass		VanBuren		Southwest MI		Michigan	
	Rate	Count	Rate	Count	Rate	Count	Rate	Count	Rate	Count
1990	‡	~	‡	~	‡	~	‡	~	18.4	159
1991	‡	~	‡	~	‡	~	‡	~	20.5	179
1992	‡	~	‡	~	‡	~	15.9	5	18.8	165
1993	‡	~	‡	~	‡	~	20.5	6	22.0	196
1994	‡	~	‡	~	‡	~	‡	~	21.1	193
1995	‡	~	‡	~	‡	~	‡	~	23.1	216
1996	‡	~	‡	~	‡	~	‡	~	20.4	190
1997	‡	~	‡	~	‡	~	‡	~	18.2	171
1998	‡	~	‡	~	‡	~	19.8	6	22.7	217
1999	40.3	7	‡	~	‡	~	26.3	8	16.6	162
2000	‡	~	‡	~	‡	~	‡	~	16.7	164
2001	31.2	6	‡	~	‡	~	22.1	7	15.4	153
2002	‡	~	‡	~	‡	~	‡	~	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 Southwest Michigan is defined by the Southwest Michigan Asthma Coalition coverage area (Berrien, Cass, VanBuren 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 Berrien, Cass, and VanBuren Counties, Southwest Michigan [5], and the State of Michigan, 1990-2002, Compared to the Healthy People 2010 Target (Objective 1-9a).

Year	HP 2010 Objective	Berrien		Cass		VanBuren		Southwest MI		Michigan	
		Rate	Count	Rate	Count	Rate	Count	Rate	Count	Rate	Count
1990	17.3	67.1	292	35.2	47	27.4	56	51.1	395	32.8	8,063
1991	17.3	44.8	195	46.2	61	19.8	41	38.3	297	29.2	7,254
1992	17.3	38.0	165	42.2	55	23.0	48	34.7	268	30.9	7,735
1993	17.3	37.4	163	36.6	48	21.9	46	33.1	257	31.2	7,875
1994	17.3	27.1	118	22.8	30	23.2	49	25.3	197	26.6	6,757
1995	17.3	30.2	132	16.6	22	13.1	28	23.3	182	32.1	8,221
1996	17.3	29.3	127	19.8	26	17.7	38	24.5	191	30.1	7,769
1997	17.3	31.3	134	19.3	25	14.0	30	24.5	189	30.0	7,742
1998	17.3	18.4	78	‡	16	12.1	26	15.7	120	21.7	5,594
1999	17.3	19.0	80	‡	16	10.7	23	15.6	119	21.4	5,546
2000	17.3	19.1	80	‡	20	10.8	23	16.1	123	26.0	6,693
2001	17.3	15.6	65	‡	17	22.2	47	17.1	129	23.7	6,089
2002	17.3	19.2	79	‡	17	‡	18	15.3	114	20.8	5,359

Spearman's ρ	-0.87**	Ψ	Ψ	-0.93**	-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 Southwest Michigan is defined by the Southwest Michigan Asthma Coalition coverage area (Berrien, Cass, VanBuren 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 Berrien, Cass, and VanBuren Counties, Southwest Michigan [5], and the State of Michigan, 1990-2002, Compared to the Healthy People 2010 Target (Objective 24-2).

Year	HP 2010 Objective	Berrien		Cass		VanBuren		Southwest MI		Michigan	
		Rate	Count	Rate	Count	Rate	Count	Rate	Count	Rate	Count
1990	25.0	181.2	220	‡	40	75.9	42	142.2	302	66.1	4,712
1991	25.0	115.1	140	‡	50	52.2	29	103.2	219	57.1	4,106
1992	25.0	105.4	128	‡	44	52.1	29	95.0	201	64.4	4,638
1993	25.0	77.9	94	‡	30	46.7	26	71.3	150	59.6	4,291
1994	25.0	63.4	75	‡	15	56.4	31	58.5	121	53.2	3,783
1995	25.0	62.5	72	‡	13	‡	16	50.0	101	63.9	4,457
1996	25.0	72.4	81	‡	10	52.6	28	60.3	119	59.6	4,092
1997	25.0	74.9	82	‡	13	‡	20	59.5	115	59.2	4,019
1998	25.0	49.3	53	‡	7	‡	17	40.4	77	40.5	2,734
1999	25.0	48.0	51	‡	9	‡	13	38.6	73	40.6	2,725
2000	25.0	40.9	43	‡	13	‡	13	36.8	69	48.8	3,257
2001	25.0	44.1	46	‡	10	64.2	33	48.0	89	50.5	3,341
2002	25.0	43.3	45	‡	8	‡	10	34.3	63	45.8	3,039

Spearman's ρ	-0.93**	Ψ	Ψ	-0.92**	-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 Southwest Michigan is defined by the Southwest Michigan Asthma Coalition coverage area (Berrien, Cass, VanBuren 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 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 Berrien, Cass, and VanBuren Counties, Southwest Michigan [5], and the State of Michigan, 1990-2002, Compared to the Healthy People 2010 Target (Objective 24-2).

Year	HP 2010 Objective	Berrien		Cass		VanBuren		Southwest MI		Michigan	
		Rate	Count	Rate	Count	Rate	Count	Rate	Count	Rate	Count
1990	7.7	12.1	161	10.4	42	11.1	62	11.5	265	14.0	10,229
1991	7.7	12.8	169	11.0	44	8.7	50	11.5	263	13.7	10,132
1992	7.7	8.9	115	8.2	32	9.4	54	8.9	201	13.6	10,205
1993	7.7	12.1	156	11.3	45	8.5	51	11.0	252	15.5	11,693
1994	7.7	9.6	121	9.3	37	10.3	61	9.7	219	14.5	11,008
1995	7.7	11.3	147	7.9	32	8.4	49	9.9	228	15.5	11,986
1996	7.7	8.4	108	10.8	44	8.3	50	8.7	202	15.0	11,734
1997	7.7	11.1	144	6.5	27	5.0	30	8.7	201	14.2	11,268
1998	7.7	7.8	100	7.2	29	7.0	41	7.4	170	13.2	10,521
1999	7.7	6.5	84	7.8	33	6.4	39	6.7	156	13.2	10,570
2000	7.7	8.5	110	7.5	32	8.1	50	8.2	192	13.3	10,776
2001	7.7	7.1	94	7.6	32	8.5	54	7.6	180	12.3	9,999
2002	7.7	7.8	101	6.2	25	6.4	40	7.1	166	11.5	9,423

Spearman's ρ	-0.82**	-0.79**	-0.74**	-0.90**	-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 Southwest Michigan is defined by the Southwest Michigan Asthma Coalition coverage area (Berrien, Cass, VanBuren 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 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 Berrien, Cass, and VanBuren Counties, Southwest Michigan [5], and the State of Michigan, 1990-2002, Compared to the Healthy People 2010 Target (Objective 24-2).

Year	HP 2010 Objective	Berrien		Cass		VanBuren		Southwest MI		Michigan	
		Rate	Count	Rate	Count	Rate	Count	Rate	Count	Rate	Count
1990	11.0	15.6	35	50.3	30	‡	16	21.9	81	25.8	2,849
1991	11.0	15.8	35	‡	19	‡	14	17.8	68	24.3	2,757
1992	11.0	15.9	35	‡	17	‡	12	16.9	64	23.9	2,754
1993	11.0	23.5	54	34.9	23	‡	13	23.0	90	25.5	2,991
1994	11.0	17.3	40	‡	12	‡	17	17.7	69	23.9	2,818
1995	11.0	11.3	26	‡	11	‡	6	11.0	43	20.9	2,502
1996	11.0	14.1	33	‡	7	‡	8	12.3	48	18.6	2,232
1997	11.0	9.9	23	‡	5	‡	8	9.1	36	16.8	2,033
1998	11.0	12.5	29	‡	~	‡	~	11.1	43	16.8	2,034
1999	11.0	‡	14	‡	7	‡	9	7.6	30	17.2	2,090
2000	11.0	9.3	22	‡	9	‡	5	9.0	36	15.2	1,853
2001	11.0	‡	17	‡	14	‡	5	9.1	36	16.5	2,023
2002	11.0	9.2	22	‡	~	‡	~	8.5	34	18.1	2,234

Spearman's ρ	Ψ	Ψ	Ψ	Ψ	-0.88**	-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 Southwest Michigan is defined by the Southwest Michigan Asthma Coalition coverage area (Berrien, Cass, VanBuren 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 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?ld=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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