

Epidemiology of Asthma

In Wayne County, Michigan

Elizabeth Wasilevich, MPH
Asthma Epidemiologist
Bureau of Epidemiology
Michigan Department of Community Health
517.335.8164

Publication Date:
August 2005

Development and publication of this report was supported by Cooperative Agreement number U59-CCU517742 from the Centers for Disease Control and Prevention (CDC). Its contents are solely the responsibility of the authors and do not necessarily represent the official views of the CDC.

Table of Contents	page
Section 1: Asthma Prevalence	4
Section 2: Hospitalization for Asthma	6
Total Population, 3-Year Rates	8
Total Population, Annual Rates	9
Sex Stratified, 3-Year Rates	10
Sex Stratified, Annual Rates	11
Race Stratified, 3-Year Rates	12
Race Stratified, Annual Rates	13
Sex and Race Stratified, 3-Year Rates	14
Sex and Race Stratified, Annual Rates	15
Income Stratified, 3-Year Rates	16
Age Stratified (0-4, 5-14, 15-34, 35-64, and ≥65), 3-Year Rates	17
Age Stratified (0-4, 5-14, 15-34, 35-64, and ≥65), Annual Rates	18
Age Stratified (<18 and ≥18), 3-Year Rates	19
Age Stratified (<18 and ≥18), Annual Rates	20
Total Population by Zip Code, 3-Year Rates	21
Section 3: Asthma Mortality	23
Total Population, 3-Year Rates	24
Total Population, Annual Rates	25
Sex Stratified, 3-Year Rates	26
Race Stratified, 3-Year Rates	27
Age Stratified (<18 and ≥18), 3-Year Rates	28
Section 4: <i>Healthy People 2010</i> Objectives for Asthma	29
<u>Hospitalization:</u>	
Children Aged <18 Years, 3-Year Rates	30
Children Aged <18 Years, Annual Rates	31
Age Stratified (0-4, 5-64, and ≥65), 3-Year Rates	32
Age Stratified (0-4, 5-64, and ≥65), Annual Rates	33
<u>Mortality:</u>	
Age Stratified (0-4, 5-14, 15-34, 35-64, and ≥65), 3-Year Rates	34

<i>Table of Contents (continued)</i>	page
Section 5: Appendix	35
<u>Hospitalization:</u>	
Total Population, Annual Rates for County and State	36
Males, Annual Rates for County and State	37
Females, Annual Rates for County and State	38
Whites, Annual Rates for County and State	39
Blacks, Annual Rates for County and State	40
White Males, Annual Rates for County and State	41
White Females, Annual Rates for County and State	42
Black Males, Annual Rates for County and State	43
Black Females, Annual Rates for County and State	44
Children Aged 0-4 Years, Annual Rates for County and State	45
Children Aged 5-14 Years, Annual Rates for County and State	46
Children/Adults Aged 15-34 Years, Annual Rates for County and State	47
Adults Aged 35-64 Years, Annual Rates for County and State	48
Adults Aged ≥65 Years, Annual Rates for County and State	49
Children Aged <18 Years, Annual Rates for County and State	50
Adults Aged ≥18 Years, Annual Rates for County and State	51
Wayne County, 3-Year Rates	52
<u>Mortality:</u>	
Total Population, Annual Rates for County and State	53
<u>HP 2010 Hospitalization:</u>	
Children Aged <18 Years, Annual Rates for County and State	54
Children Aged 0-4 Years, Annual Rates for County and State	55
Children/Adults Aged 5-64 Years, Annual Rates for County and State	56
Adults Aged ≥65 Years, Annual Rates for County and State	57
Section 6: Data Sources	58
Section 7: Methods	60

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 Wayne County and the State of Michigan.

	Children (<18 Years)	Adults (≥18 Years)
	2002	2003
Wayne County	52,013	136,216
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 BRFSS.

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 BRFSS.

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.

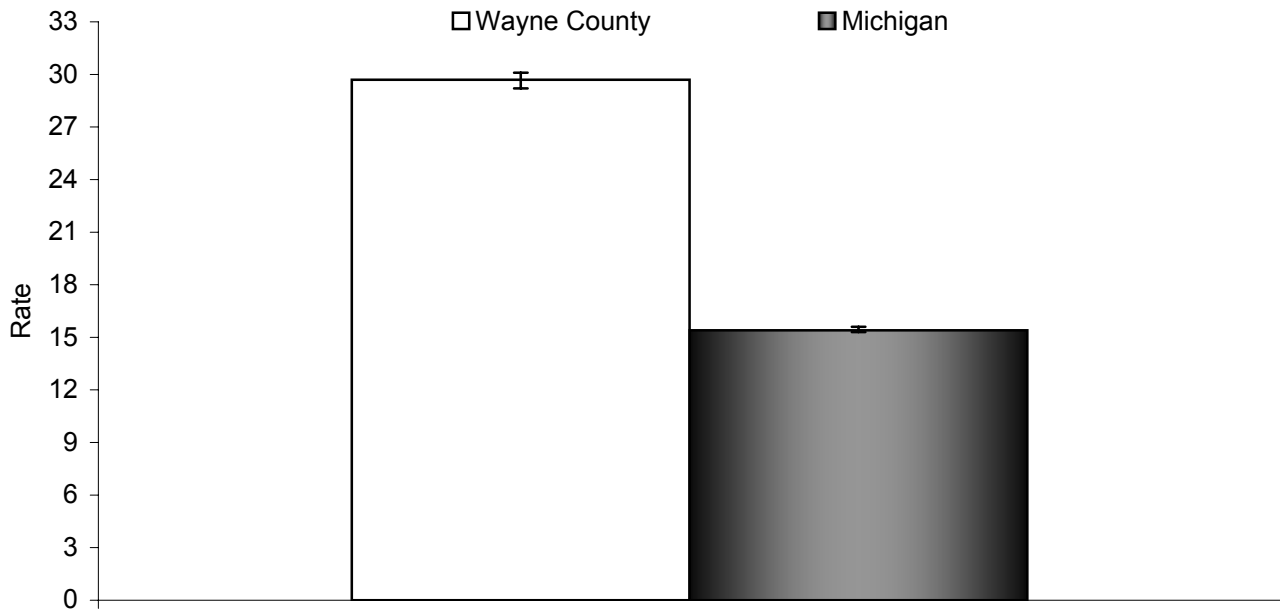
These data are the number of inpatient hospitalizations for asthma. This is not the same as the number of individual people hospitalized for asthma. An individual can be hospitalized more than once for the same condition during the study period and multiple hospitalizations cannot be distinguished from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



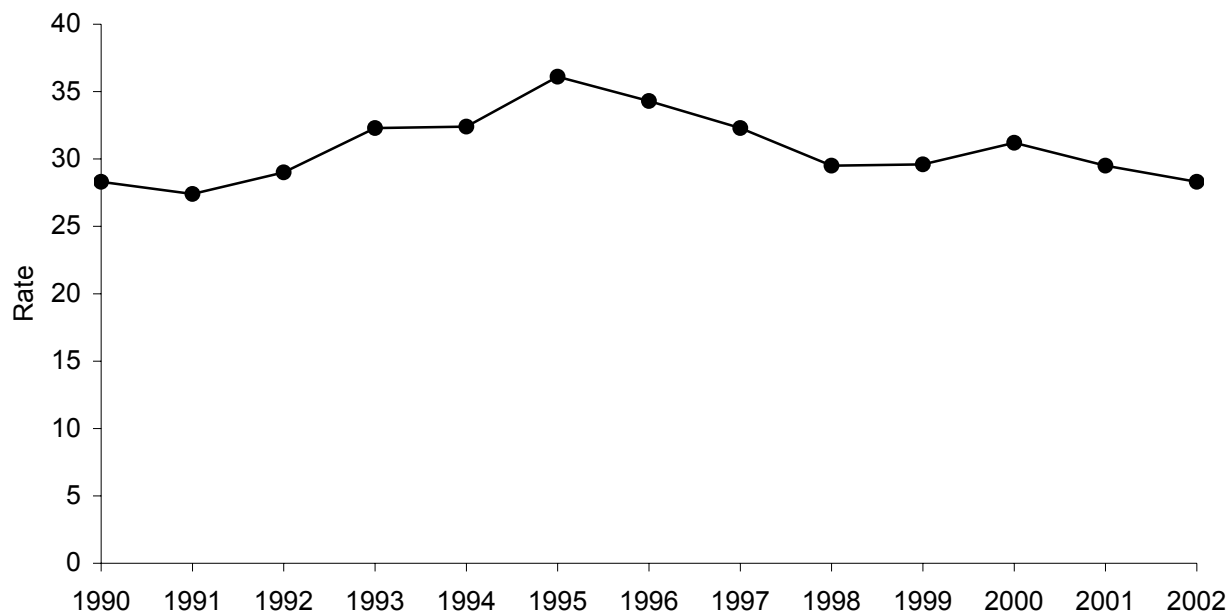
- 1 Rates are age adjusted to the 2000 US standard population by the direct standardization method. Hospitalization records with missing age are excluded.
- 2 Population estimates are taken from the Michigan population estimates for 2001.
- 3 Asthma hospitalization is defined as a primary discharge diagnosis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

	Total Population
Wayne County Rate	29.7
95% CI	29.2 , 30.1
Count	18,525
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 Wayne County, 2000-2002, is 6,175.
- ✧ Wayne County has significantly higher 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 Wayne County, 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.

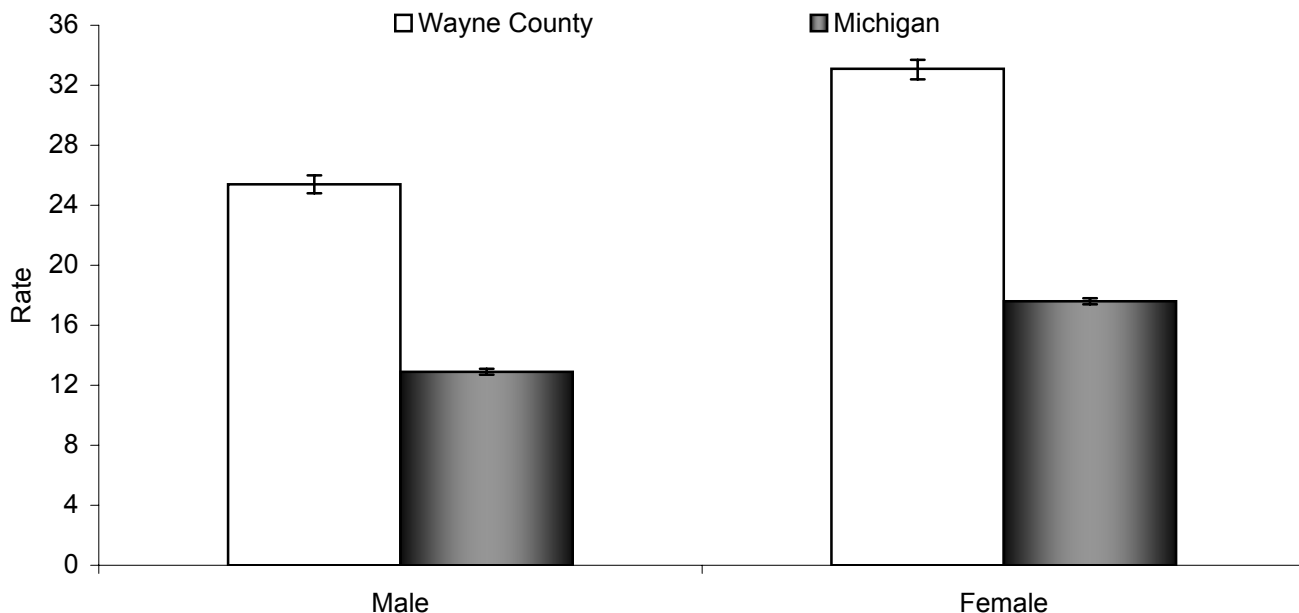
Year	Total Population	
	Rate	Count
1990	28.3	6,027
1991	27.4	5,857
1992	29.0	6,265
1993	32.3	6,951
1994	32.4	6,918
1995	36.1	7,828
1996	34.3	7,395
1997	32.3	6,942
1998	29.5	6,221
1999	29.6	6,179
2000	31.2	6,519
2001	29.5	6,149
2002	28.3	5,857

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

✧ Between 1990 and 2002, there has not been a significant trend in asthma hospitalization rates for the total population in Wayne County ($\rho = 0.09$, $p = 0.77$).

See appendix page 36 for supporting data.

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



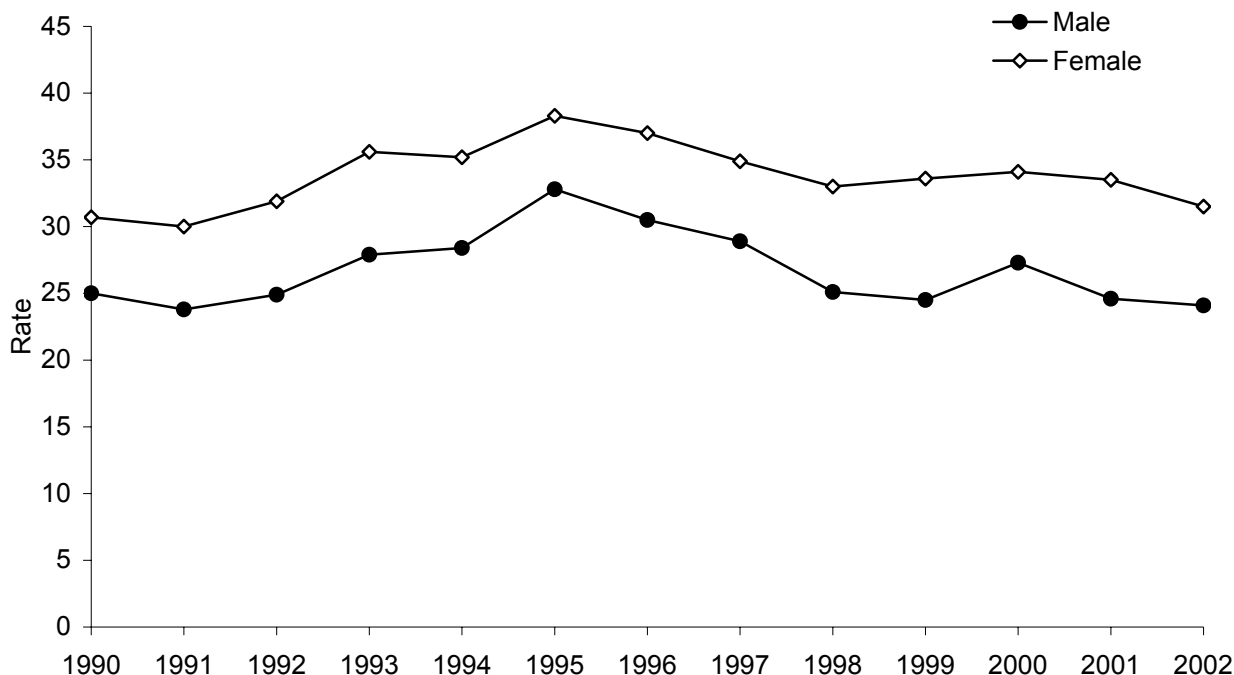
- 1 Rates are age adjusted to the 2000 US standard population by the direct standardization method. Hospitalization records with missing age are excluded.
- 2 Population estimates are taken from the Michigan population estimates for 2001.
- 3 Asthma hospitalization is defined as a primary discharge diagnosis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

	Male	Female
Wayne County Rate	25.4	33.1
95% CI	24.8 , 26.0	32.4 , 33.7
Count	7,924	10,601
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 Wayne County are significantly higher than the respective rates for the State of Michigan as a whole, 2000-2002.
- ✧ In Wayne County 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 Wayne County, 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.

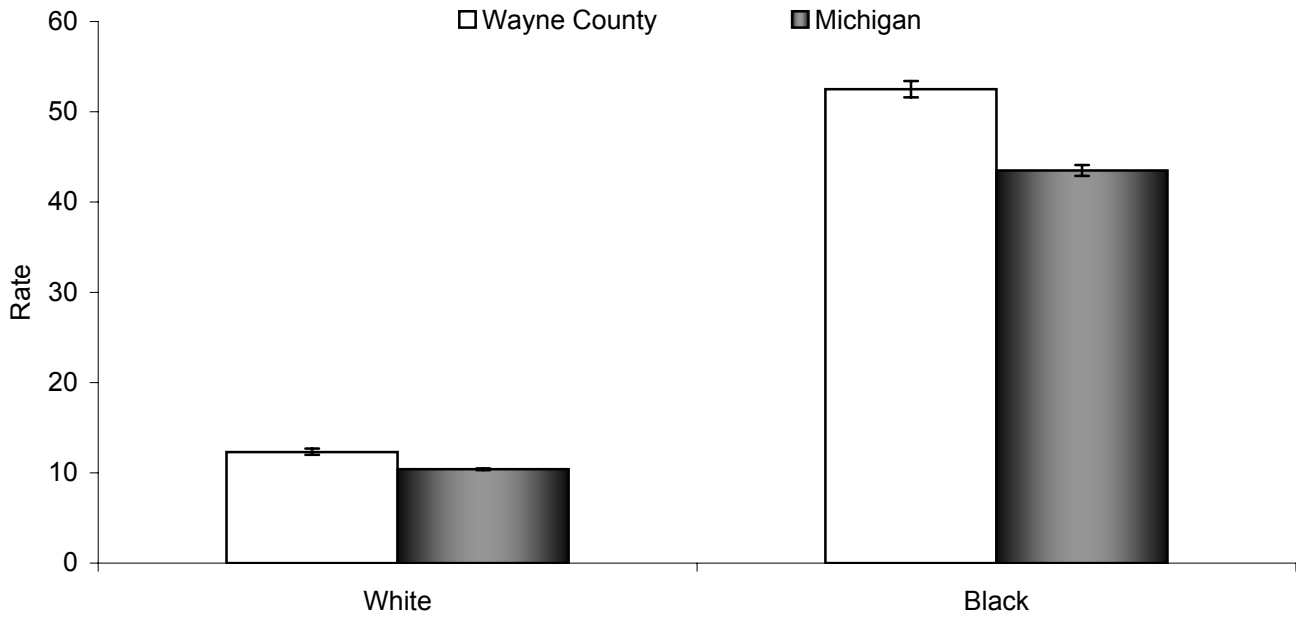
Year	Male		Female	
	Rate	Count	Rate	Count
1990	25.0	2,637	30.7	3,390
1991	23.8	2,554	30.0	3,303
1992	24.9	2,714	31.9	3,550
1993	27.9	2,999	35.6	3,952
1994	28.4	3,044	35.2	3,874
1995	32.8	3,584	38.3	4,244
1996	30.5	3,316	37.0	4,079
1997	28.9	3,133	34.9	3,809
1998	25.1	2,655	33.0	3,566
1999	24.5	2,569	33.6	3,610
2000	27.3	2,879	34.1	3,640
2001	24.6	2,562	33.5	3,587
2002	24.1	2,483	31.5	3,374

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

✧ Between 1990 and 2002, there has not been a significant trend in asthma hospitalization rates for the male or female population in Wayne County.

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 Wayne County and the State of Michigan, All Ages, 2000-2002.



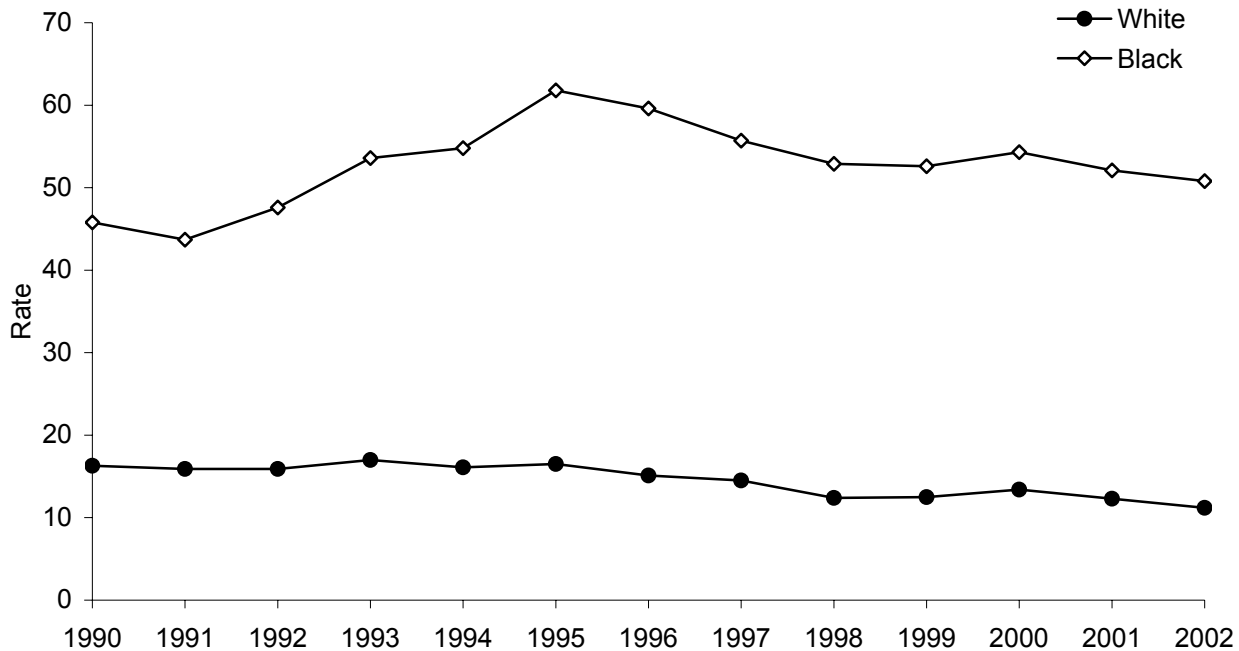
- 1 Rates are age adjusted to the 2000 US standard population by the direct standardization method. Hospitalization records with missing age are excluded.
- 2 Population estimates are taken from the Michigan population estimates for 2001.
- 3 Asthma hospitalization is defined as a primary discharge diagnosis 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.

	White	Black
Wayne County Rate	12.3	52.5
95% CI	12.0 , 12.7	51.6 , 53.4
Count	4,168	14,214
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 Wayne County are significantly higher than the respective rates for the State of Michigan as a whole, 2000-2002.
- ✧ The asthma hospitalization rates for white persons in Wayne County and the State of Michigan are significantly lower than the respective rates for black persons, 2000-2002.
- ✧ While black persons in the State of Michigan have a higher asthma hospitalization rate, white persons experience the greatest absolute burden of asthma hospitalization.

Figure 6. Annual Rates (per 10,000) [1,2] of Asthma [3] Hospitalization by Race [4], All Ages, for Wayne County, 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.

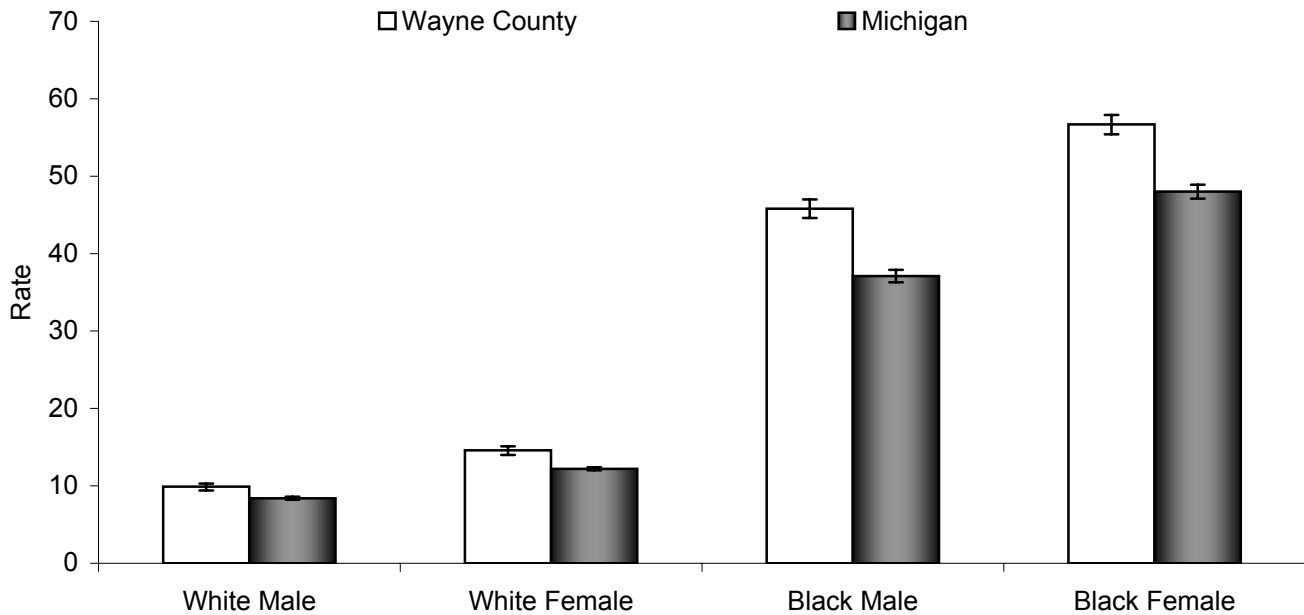
Year	White		Black	
	Rate	Count	Rate	Count
1990	16.3	2,005	45.8	4,006
1991	15.9	1,926	43.7	3,907
1992	15.9	1,938	47.6	4,291
1993	17.0	2,068	53.6	4,839
1994	16.1	1,921	54.8	4,955
1995	16.5	1,951	61.8	5,808
1996	15.1	1,779	59.6	5,562
1997	14.5	1,684	55.7	5,222
1998	12.4	1,436	52.9	4,767
1999	12.5	1,436	52.6	4,701
2000	13.4	1,510	54.3	4,973
2001	12.3	1,388	52.1	4,712
2002	11.2	1,270	50.8	4,529

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 white persons in Wayne County ($\rho = -0.85$, $p < 0.01$).

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 Wayne County and the State of Michigan, All Ages, 2000-2002.



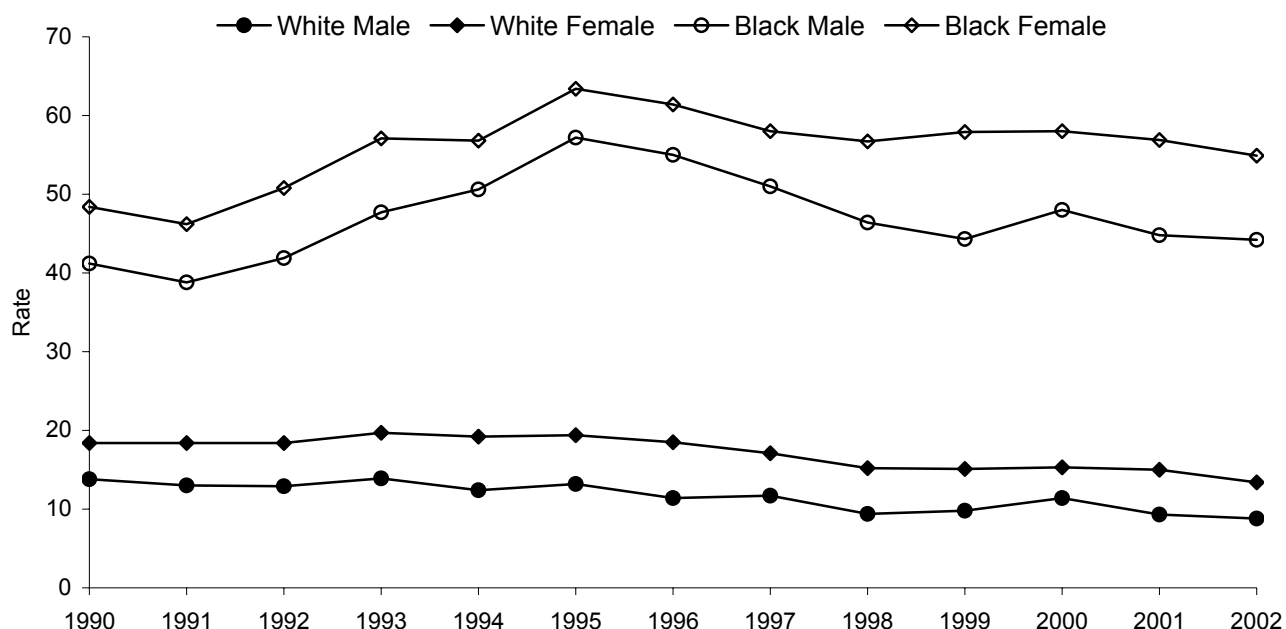
- 1 Rates are age adjusted to the 2000 US standard population by the direct standardization method. Hospitalization records with missing age are excluded.
- 2 Population estimates are taken from the Michigan population estimates for 2001.
- 3 Asthma hospitalization is defined as a primary discharge diagnosis 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.

	White Male	White Female	Black Male	Black Female
Wayne County Rate	9.9	14.6	45.8	56.7
95% CI	9.4 , 10.3	14.0 , 15.1	44.6 , 47.0	55.4 , 57.9
Count	1,614	2,554	6,236	7,978
Michigan Rate	8.4	12.2	37.1	48.0
95% CI	8.2 , 8.6	12.0 , 12.4	36.3 , 37.9	47.1 , 48.9
Count	9,916	15,539	8,702	10,983

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

- ✧ In Wayne County, the asthma hospitalization rate for black females is significantly higher than the rates among white males, white females, or black males, 2000-2002.
- ✧ In Wayne County, the asthma hospitalization rate for black persons is significantly higher than the rate among white persons, 2000-2002, regardless of sex.
- ✧ The asthma hospitalization rates for all race/sex strata in Wayne County are significantly higher than respective rates for the State of Michigan as a whole, 2000-2002.

Figure 8. Annual Rates (per 10,000) [1,2] of Asthma [3] Hospitalization by Sex and Race [4], All Ages, for Wayne County, 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.

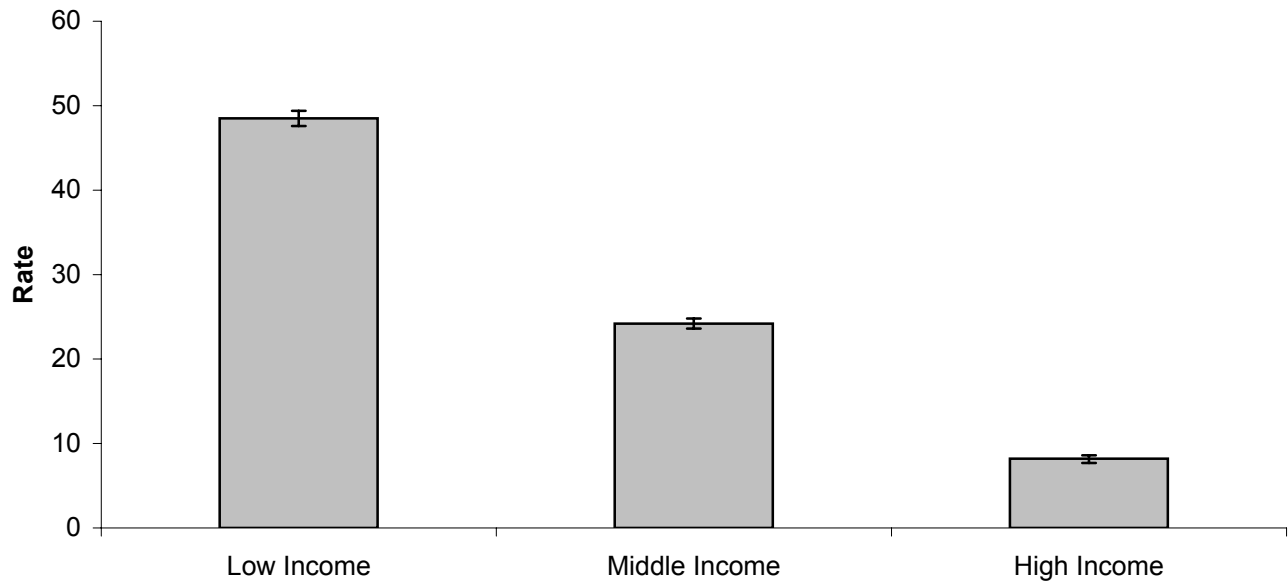
Year	White Male		White Female		Black Male		Black Female	
	Rate	Count	Rate	Count	Rate	Count	Rate	Count
1990	13.8	819	18.4	1,186	41.2	1,812	48.4	2,194
1991	13.0	763	18.4	1,163	38.8	1,784	46.2	2,123
1992	12.9	764	18.4	1,173	41.9	1,936	50.8	2,355
1993	13.9	807	19.7	1,261	47.7	2,175	57.1	2,664
1994	12.4	713	19.2	1,208	50.6	2,314	56.8	2,641
1995	13.2	756	19.4	1,195	57.2	2,789	63.4	3,019
1996	11.4	652	18.5	1,127	55.0	2,639	61.4	2,923
1997	11.7	668	17.1	1,016	51.0	2,452	58.0	2,770
1998	9.4	526	15.2	910	46.4	2,118	56.7	2,649
1999	9.8	542	15.1	894	44.3	2,009	57.9	2,692
2000	11.4	623	15.3	887	48.0	2,240	58.0	2,733
2001	9.3	508	15.0	880	44.8	2,031	56.9	2,681
2002	8.8	483	13.4	787	44.2	1,965	54.9	2,564

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 white male and white female populations in Wayne County (white male, $\rho = -0.89$, $p < 0.01$; white female, $\rho = -0.74$, $p < 0.01$).

See appendix pages 41 through 44 for supporting data.

Figure 9. Rates (per 10,000) [1,2] of Hospitalization due to Asthma [3] by Income [4] for Wayne County, 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.

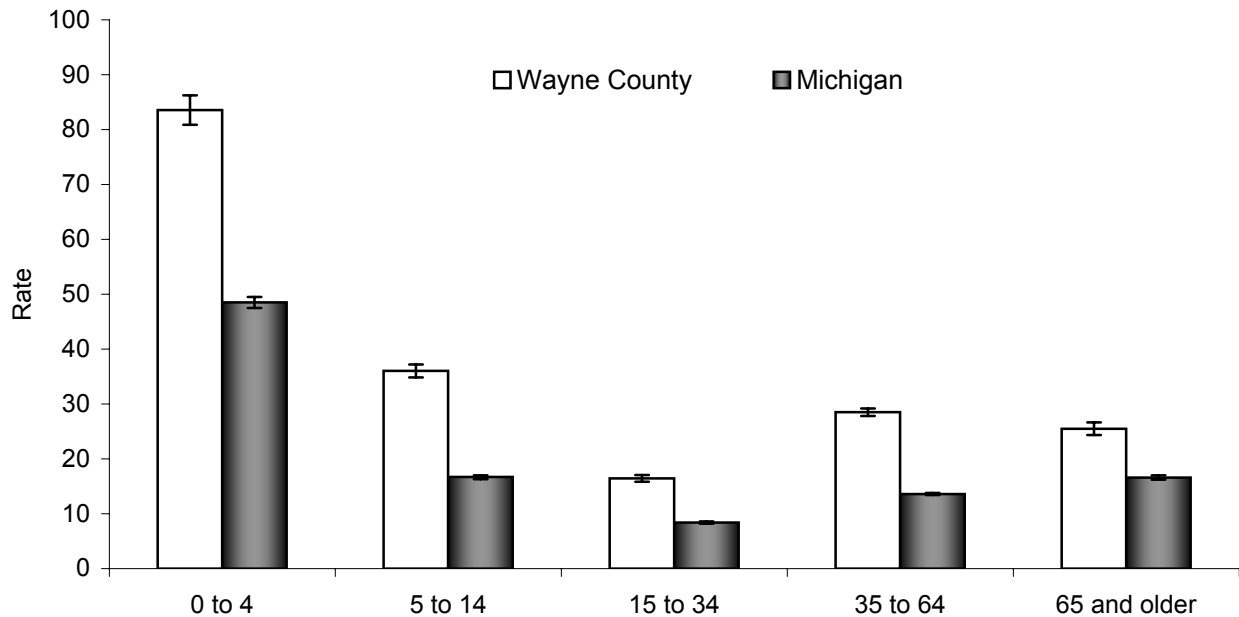
4 High income = top 20% of Michigan's zip code areas, as determined by median household income from Census 2000; Low income = bottom 20% of Michigan's zip code areas, as determined by median household income from Census 2000; all others are considered middle income.

	Low Income	Middle Income	High Income
Wayne County Rate	48.5	24.2	8.2
95% CI	47.6 , 49.4	23.6 , 24.8	7.7 , 8.6
Count	11,109	6,279	1,126

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

✧ In Wayne County, the asthma hospitalization rate for low income areas is significantly higher than the rates for high or middle income areas, 2000-2002.

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



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

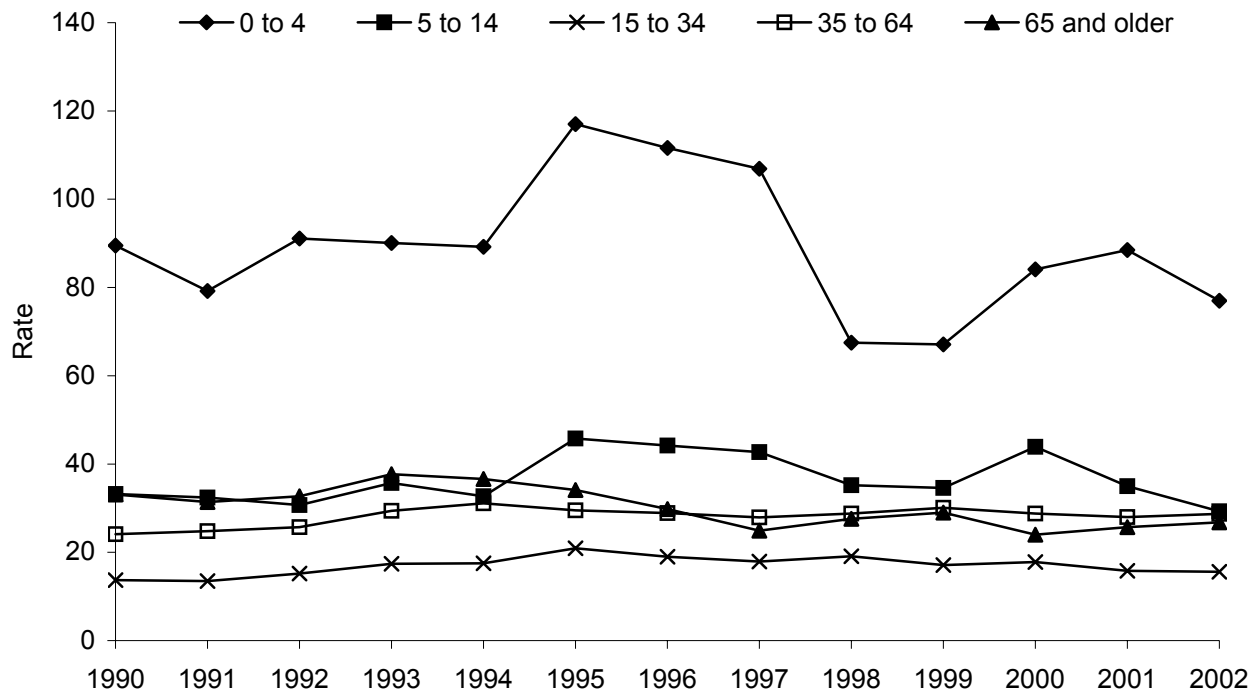
2 Asthma hospitalization is defined as a primary discharge diagnosis of asthma, ICD-9-CM=493.XX.

	0 to 4	5 to 14	15 to 34	35 to 64	65 and older
Wayne County Rate	83.6	36.0	16.4	28.5	25.5
95% CI	80.9 , 86.2	34.8 , 37.2	15.8 , 17.0	27.8 , 29.2	24.3 , 26.6
Count	3,749	3,606	2,762	6,529	1,879
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 Wayne County 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 Wayne County 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.
- ✧ The asthma hospitalization rates for all age groups in Wayne County are significantly higher than respective rates for the State of Michigan as a whole, 2000-2002.

Figure 11. Annual Rates (per 10,000) [1] of Asthma [2] Hospitalization by Age Group for Wayne County, 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.

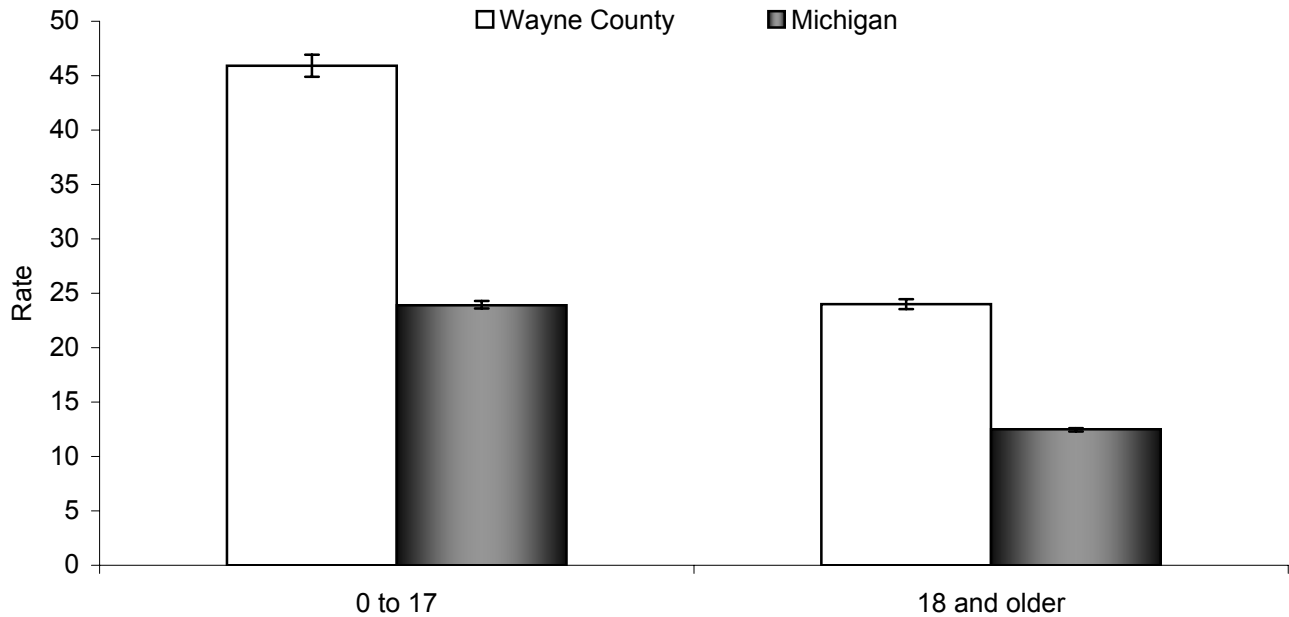
Year	0 to 4		5 to 14		15 to 34		35 to 64		65 and older	
	Rate	Count	Rate	Count	Rate	Count	Rate	Count	Rate	Count
1990	89.5	1,554	33.2	1,006	13.7	918	24.1	1,678	33.1	871
1991	79.2	1,399	32.4	995	13.5	887	24.8	1,744	31.4	832
1992	91.1	1,621	30.7	948	15.2	986	25.7	1,839	32.7	871
1993	90.1	1,603	35.7	1,118	17.4	1,108	29.4	2,117	37.7	1,005
1994	89.2	1,559	32.7	1,037	17.5	1,091	31.1	2,260	36.6	971
1995	117.0	1,986	45.8	1,482	20.9	1,290	29.5	2,167	34.1	903
1996	111.6	1,838	44.2	1,455	19.0	1,165	28.9	2,154	29.8	783
1997	106.9	1,713	42.7	1,423	17.9	1,073	27.9	2,089	24.9	644
1998	67.5	1,060	35.2	1,184	19.1	1,123	28.8	2,155	27.6	699
1999	67.1	1,035	34.6	1,171	17.1	990	30.1	2,256	29.0	727
2000	84.1	1,263	43.9	1,464	17.8	1,019	28.8	2,176	24.0	597
2001	88.5	1,324	35.0	1,169	15.8	885	28.0	2,140	25.7	631
2002	77.0	1,162	29.3	973	15.6	858	28.7	2,213	26.8	651

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

✧ Between 1990 and 2002, there has been a significant overall decrease in asthma hospitalization rates among the population aged 65 years and older in Wayne County ($\rho = -0.75$, $p < 0.01$).

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 Wayne County 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.

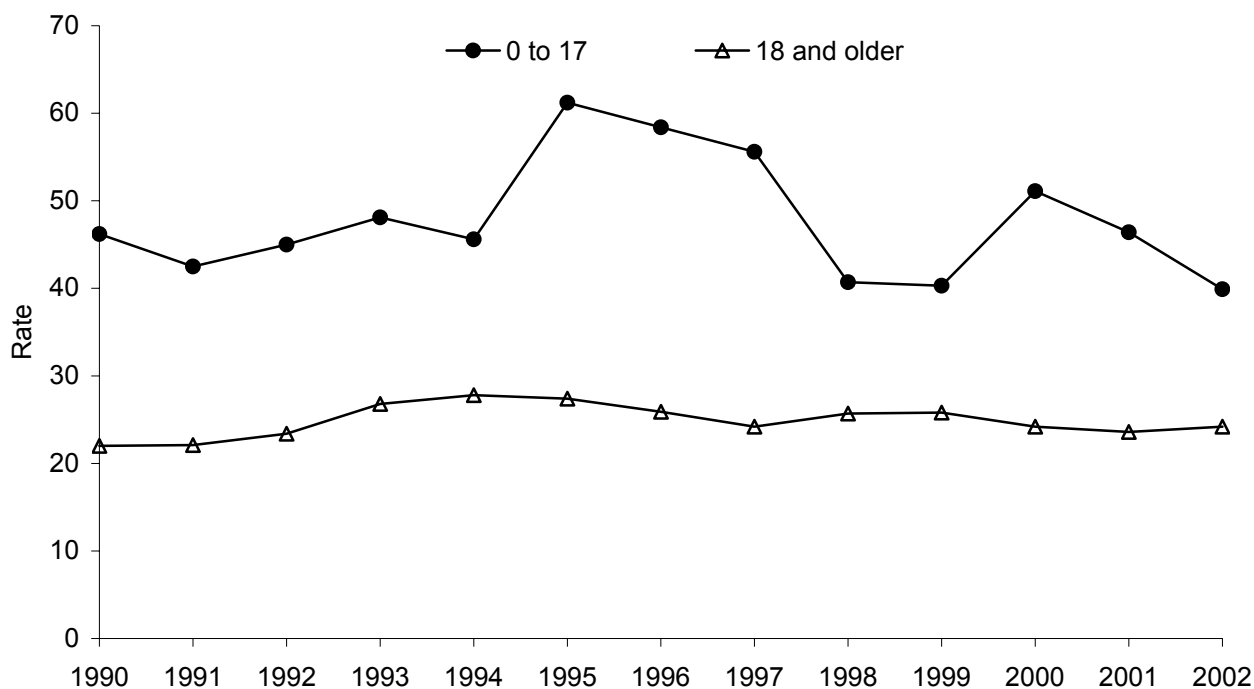
3 Asthma hospitalization is defined as a primary discharge diagnosis of asthma, ICD-9-CM=493.XX.

	0 to 17	18 and Older
Wayne County Rate	45.9	24.0
95% CI	44.9 , 46.9	23.5 , 24.5
Count	7,845	10,680
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 Wayne County and the State of Michigan, the rate of asthma hospitalization for children less than 18 years of age is significantly higher than the respective rate 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 Wayne County are significantly higher 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 Wayne County, 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.

Year	0 to 17		18 and Older	
	Rate	Count	Rate	Count
1990	46.2	2,751	22.0	3,276
1991	42.5	2,553	22.1	3,304
1992	45.0	2,743	23.4	3,522
1993	48.1	2,931	26.8	4,020
1994	45.6	2,775	27.8	4,143
1995	61.2	3,703	27.4	4,125
1996	58.4	3,507	25.9	3,888
1997	55.6	3,306	24.2	3,636
1998	40.7	2,397	25.7	3,824
1999	40.3	2,356	25.8	3,823
2000	51.1	2,930	24.2	3,589
2001	46.4	2,644	23.6	3,505
2002	39.9	2,271	24.2	3,586

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

✧ Between 1990 and 2002, there has not been a significant trend in asthma hospitalization rates for either age group in Wayne County.

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, Wayne County, All Ages, 2000-2002.

Zip Code	Count	Rate	95% Confidence Interval	
			Lower Limit	Upper Limit
48101	68	7.6	5.7	9.5
48111	229	19.9	17.2	22.5
48120	33	15.6	10.1	21.1
48122	69	21.3	16.2	26.3
48124	80	7.6	5.9	9.4
48125	83	12.0	9.4	14.6
48126	167	12.1	10.2	14.0
48127	96	9.0	7.1	10.8
48128	22	6.8	3.8	9.8
48134	57	11.7	8.5	14.9
48135	115	13.4	10.9	15.9
48138	20	‡	‡	‡
48141	306	32.7	29.0	36.4
48146	177	14.4	12.3	16.5
48150	74	8.7	6.7	10.7
48152	49	5.0	3.6	6.5
48154	90	7.7	6.1	9.4
48164	23	10.0	5.8	14.1
48167	55	5.3	3.9	6.8
48170	84	7.1	5.6	8.7
48173	20	‡	‡	‡
48174	178	19.3	16.5	22.2
48180	296	14.8	13.1	16.5
48183	108	9.0	7.3	10.7
48184	113	19.8	16.1	23.4
48185	192	12.9	11.1	14.8
48186	158	13.8	11.6	16.0
48187	117	8.9	7.2	10.6
48188	77	9.3	6.9	11.7
48192	119	8.9	7.3	10.5
48195	88	10.3	8.1	12.4
48201	395	90.5	81.5	99.5
48202	417	65.9	59.5	72.2
48203	869	63.2	58.9	67.5
48204	754	59.5	55.2	63.8
48205	1,053	53.8	50.2	57.4
48206	654	67.7	62.4	73.0
48207	499	66.1	60.2	71.9

Note: Table continued on next page.

(continued from previous page)

48208	319	83.8	74.5	93.0
48209	261	22.1	19.2	25.0
48210	441	35.8	32.3	39.3
48211	162	47.3	39.8	54.7
48212	489	35.0	31.9	38.2
48213	868	62.8	58.5	67.1
48214	636	63.4	58.4	68.4
48215	412	70.0	63.1	76.9
48216	79	42.6	32.9	52.3
48217	125	40.7	33.5	47.9
48218	62	19.7	14.7	24.7
48219	620	34.0	31.3	36.7
48221	548	41.3	37.9	44.8
48223	431	37.6	33.9	41.4
48224	771	46.4	42.9	49.8
48225	78	17.9	13.9	22.0
48226	75	61.9	43.5	80.3
48227	770	41.2	38.2	44.2
48228	717	35.3	32.6	37.9
48229	122	36.0	29.6	42.5
48230	51	9.3	6.7	11.9
48234	744	52.8	49.0	56.7
48235	646	40.4	37.3	43.6
48236	84	8.3	6.4	10.2
48238	763	55.7	51.6	59.7
48239	167	15.0	12.6	17.3
48240	69	12.2	9.3	15.1
Wayne County	18,525	29.7	29.2	30.1

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

2 Populations are taken from the 2000 US Census.

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

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

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

Section 3: Asthma Mortality

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

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

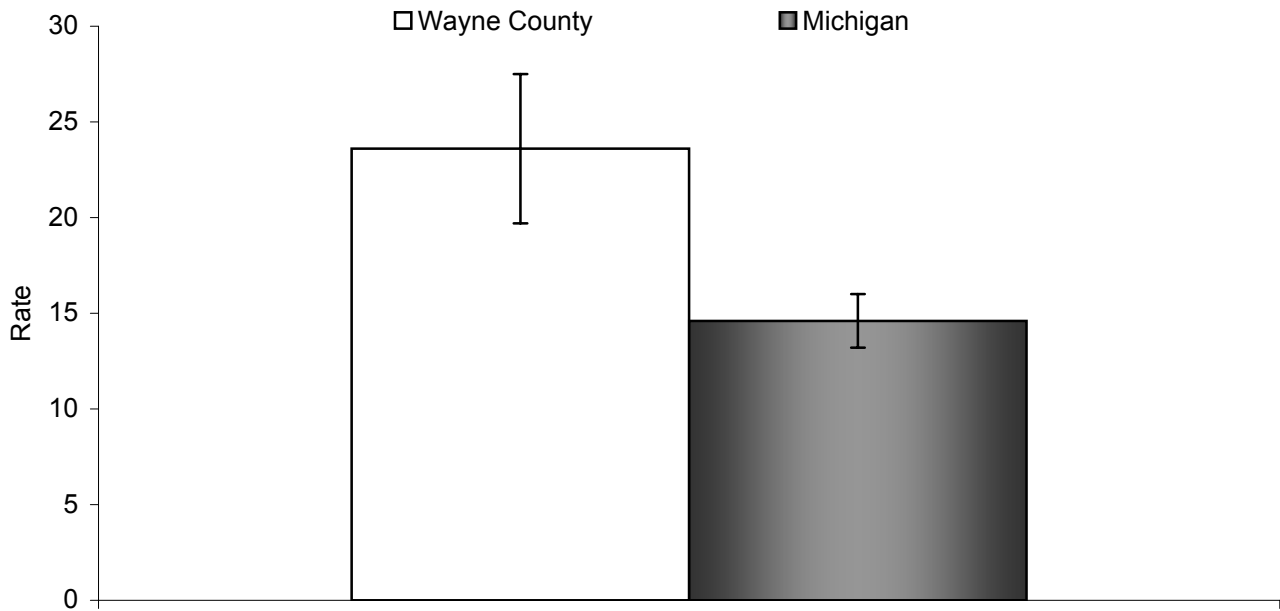
While a comparability ratio between ICD-9 and ICD-10 exists for asthma (0.8938; that is, for every 100 asthma deaths coded with ICD-9, only 89.38 would be coded as asthma using ICD-10), the analysis presented here does not attempt to compare pre-1999 data with asthma death occurring since 1999. (Anderson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

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

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

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

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



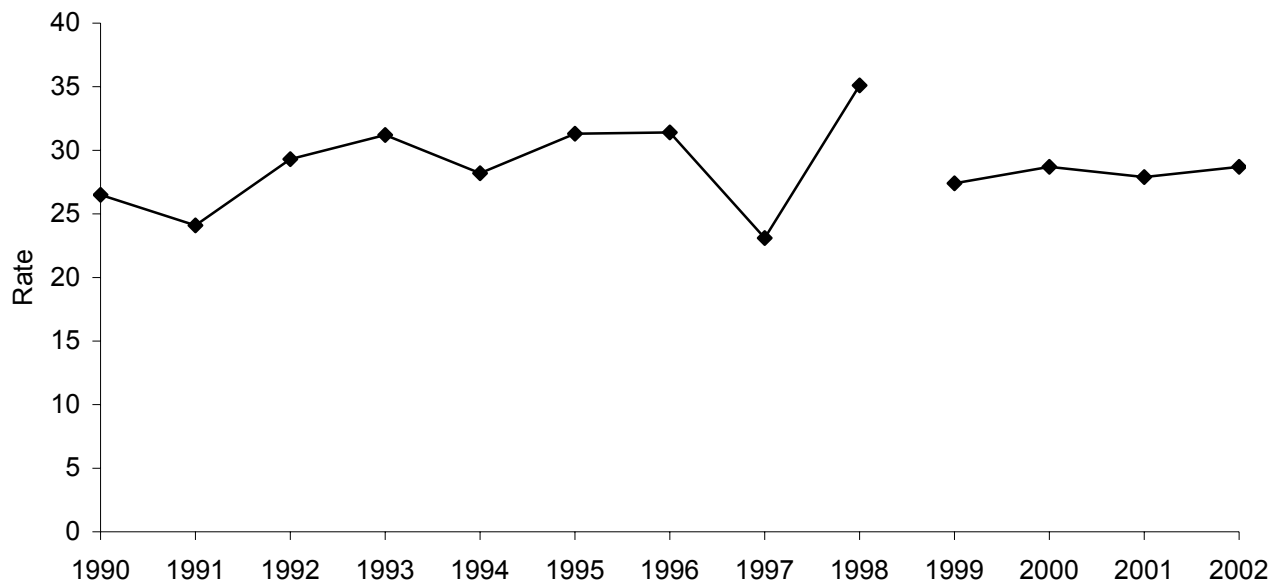
- 1 Rates are age adjusted to the 2000 US standard population by the direct standardization method.
- 2 Population estimates are taken from the Michigan population estimates for 2002.
- 3 Asthma death is defined as a primary cause of death as asthma, ICD-10=J45 or J46.

	Total Population
Wayne County Rate	23.6
95% CI	19.7 , 27.5
Count	142
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 Wayne County, 2001-2003, is 47.
- ✧ The rate of asthma mortality in Wayne County is significantly higher 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, All Ages, for Wayne County, 1990-2002 [4].



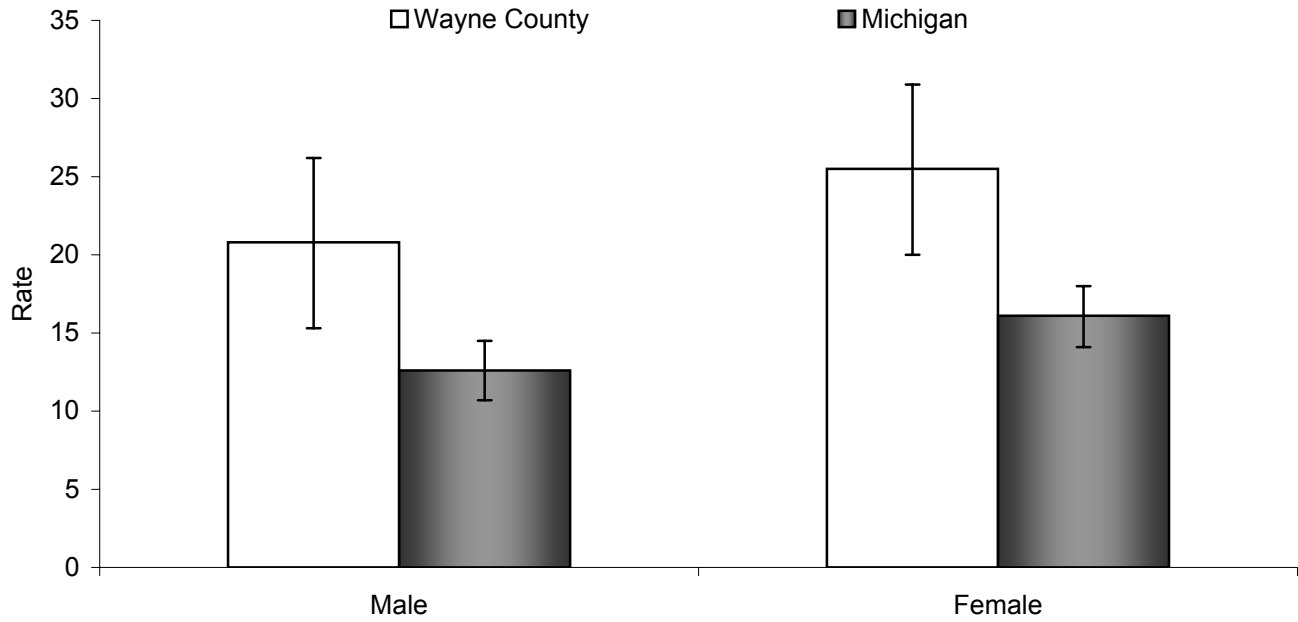
- 1 Rates are age adjusted to the 2000 US standard population by the direct standardization method.
- 2 Population estimates are taken from the Michigan population estimates for 1990-2002.
- 3 Asthma death is defined as a primary cause of death as asthma, ICD-9=493.XX and ICD-10=J45 or J46.
- 4 Due to 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	26.5	52
1991	24.1	49
1992	29.3	56
1993	31.2	63
1994	28.2	57
1995	31.3	64
1996	31.4	64
1997	23.1	46
1998	35.1	70
1999	27.4	55
2000	28.7	57
2001	27.9	55
2002	28.7	58

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

See appendix page 53 for supporting data.

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



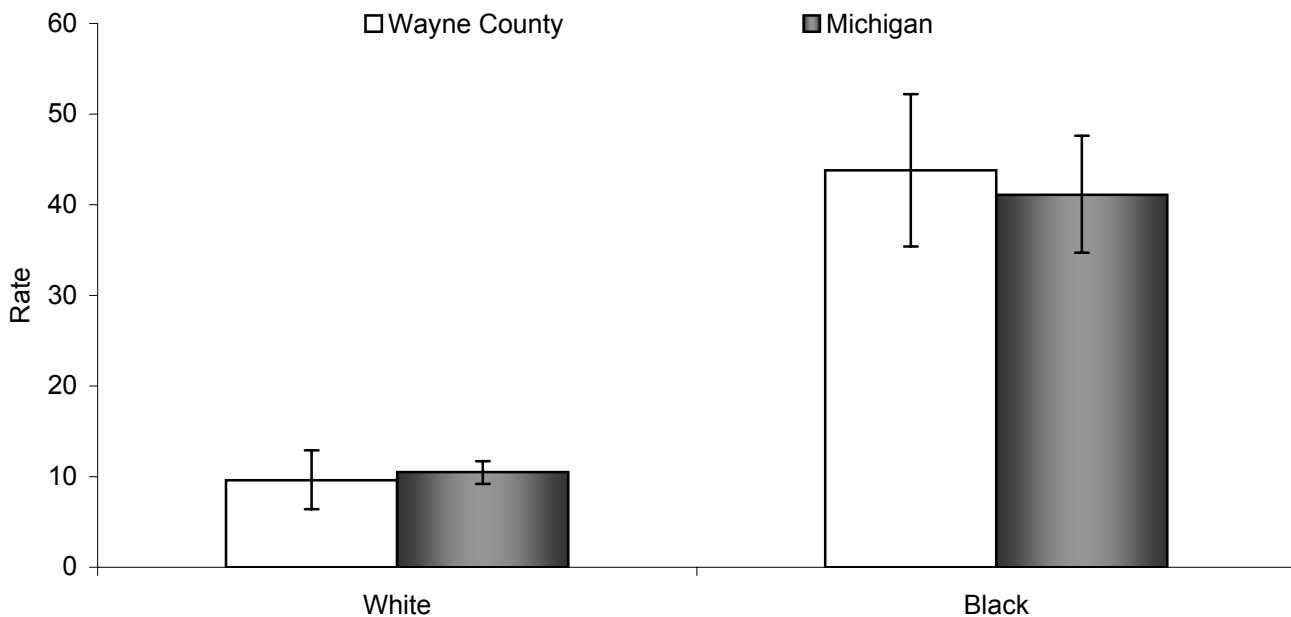
1 Rates are age adjusted to the 2000 US standard population by the direct standardization method.
 2 Population estimates are taken from the Michigan population estimates for 2002.
 3 Asthma death is defined as a primary cause of death as asthma, ICD-10=J45 or J46.

	Male	Female
Wayne County Rate	20.8	25.5
95% CI	15.3 , 26.2	20.0 , 30.9
Count	58	84
Michigan Rate	12.6	16.1
95% CI	10.7 , 14.5	14.1 , 18.0
Count	171	270

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

- ✧ The rates of asthma mortality for the male and female populations in Wayne County are significantly higher than the respective rates for the State of Michigan as a whole, 2001-2003.
- ✧ For Wayne County and 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 Wayne County and the State of Michigan, All Ages, 2001-2003.



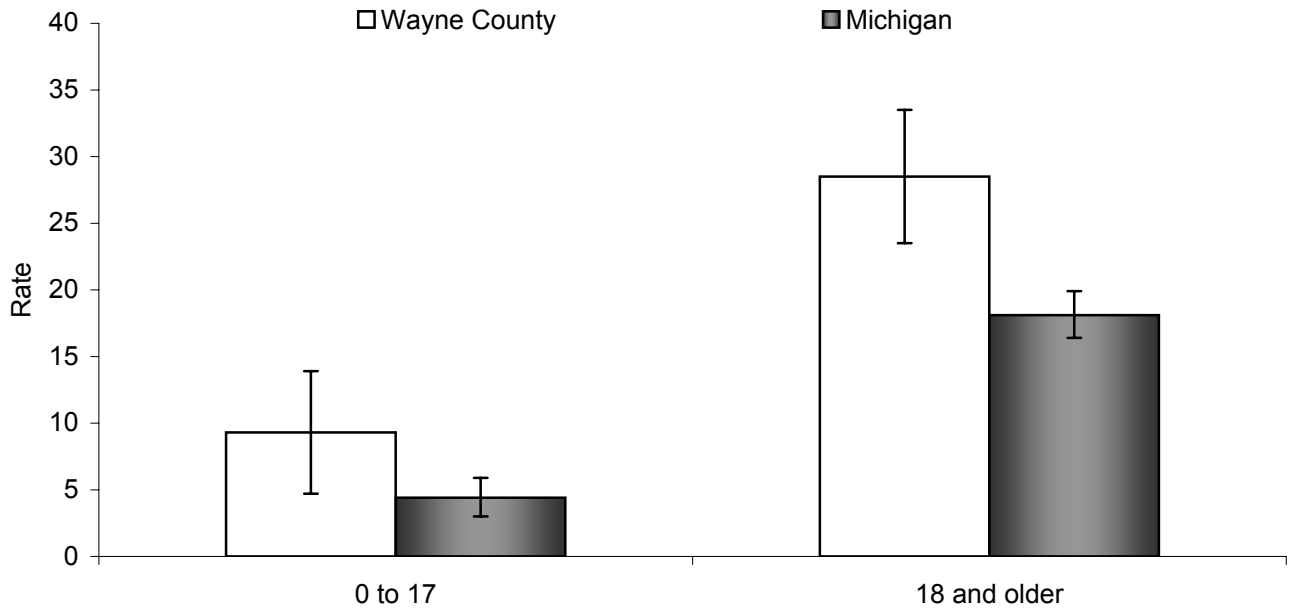
1 Rates are age adjusted to the 2000 US standard population by the direct standardization method.
 2 Population estimates are taken from the Michigan population estimates for 2002.
 3 Asthma death is defined as a primary cause of death as asthma, ICD-10=J45 or J46.

	White	Black
Wayne County Rate	9.6	43.8
95% CI	6.4 , 12.9	35.4 , 52.2
Count	35	107
Michigan Rate	10.5	41.1
95% CI	9.2 , 11.7	34.7 , 47.6
Count	273	163

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

- ✧ For Wayne County and the State of Michigan, the rate of asthma mortality for blacks is significantly higher than the rate for whites, 2001-2003.
- ✧ 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 in Wayne County 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 Wayne County 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.

	0 to 17	18 and Older
Wayne County Rate	9.3	28.5
95% CI	4.7 , 13.9	23.5 , 33.5
Count	16	126
Michigan Rate	4.4	18.1
95% CI	3.0 , 5.9	16.4 , 19.9
Count	35	406

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

- ✧ The asthma mortality rates in Wayne County and the State of Michigan are 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 Wayne County is significantly higher than the rate for the State of Michigan as a whole, 2001-2003.

Section 4: *Healthy People 2010* Objectives for Asthma

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

The following asthma hospitalization and mortality figures provide information for Wayne County 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 Wayne County 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.

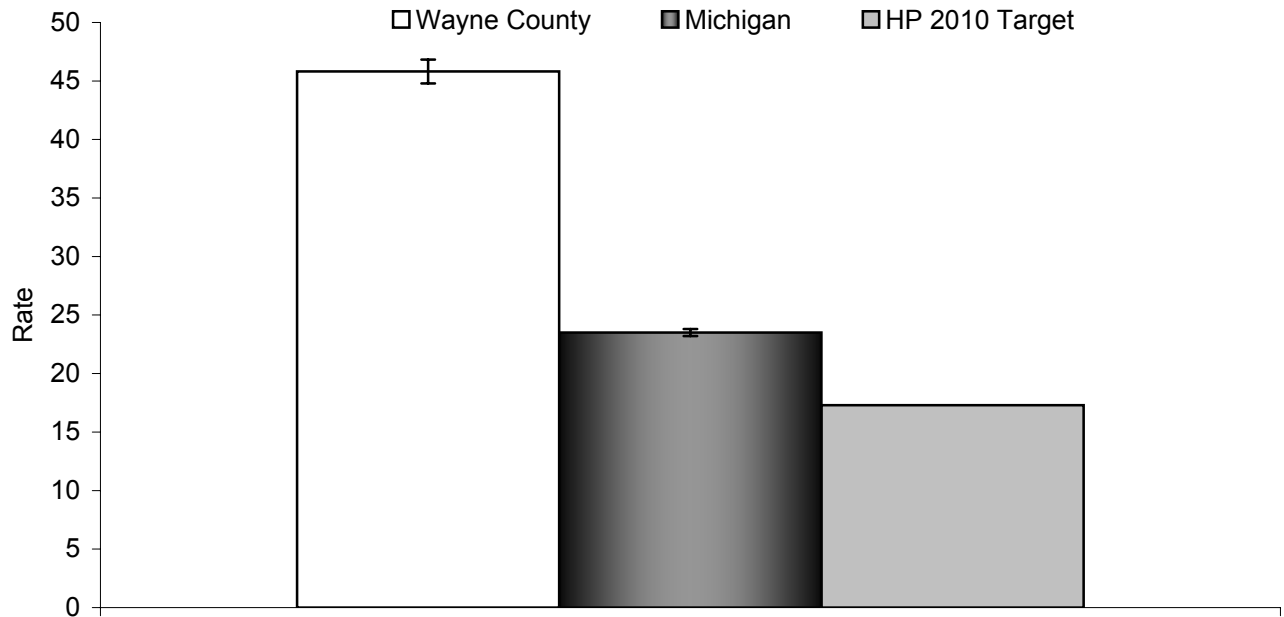
Targets: 1 per 1,000,000 (age 0-4 years)
1 per 1,000,000 (age 5-14 years)
2 per 1,000,000 (age 15-34 years)
9 per 1,000,000 (age 35-64 years)
60 per 1,000,000 (age ≥65 years)

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 Wayne County and the State of Michigan, 2000-2002, Compared to the Healthy People 2010 Target (Objective 1-9a).



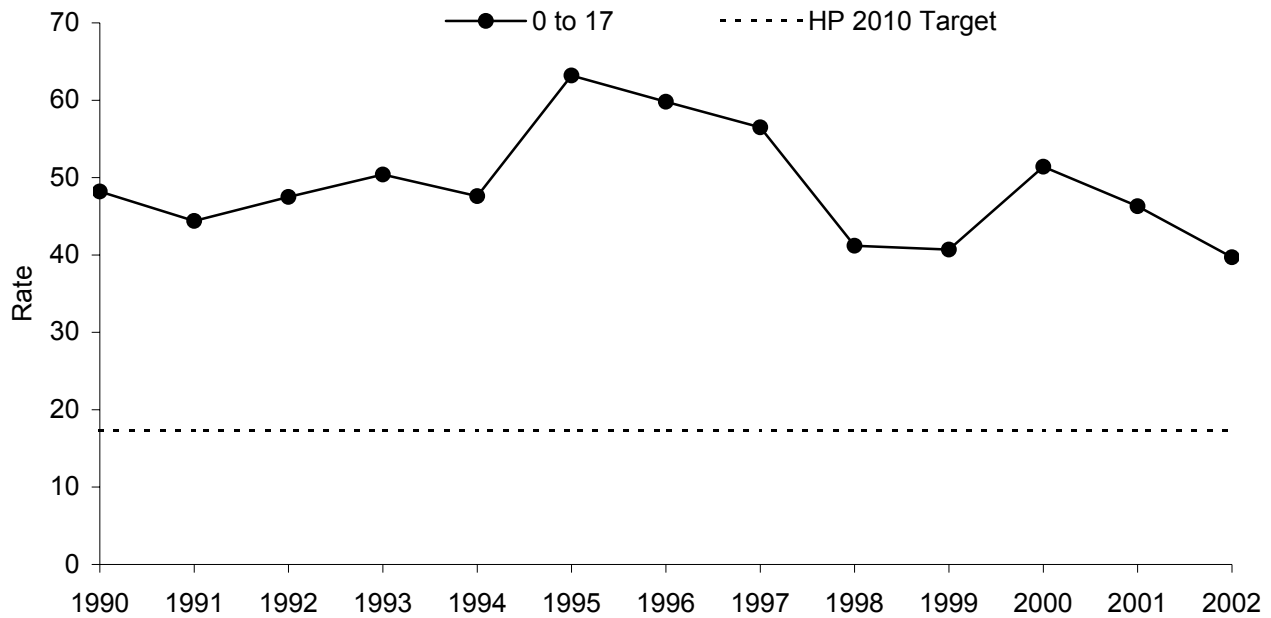
- 1 Population estimates are taken from the Michigan population estimates for 2001.
- 2 Not age adjusted in accordance with analysis prescribed by Healthy People 2010 Objectives.
- 3 Asthma hospitalization is defined as a primary discharge diagnosis of asthma, ICD-9-CM=493.XX.

	Total Population
Wayne County Rate	45.8
95% CI	44.8 , 46.8
Count	7,845
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 Wayne County, 2000-2002, is 2,615.
- ✧ The rate of asthma hospitalization for children aged less than 18 years in Wayne County, 2000-2002, is significantly higher than the *Healthy People 2010* objective.

Figure 20. Annual Rates (per 10,000) [1,2] of Asthma [3] Hospitalization for Children (aged less than 18 years) in Wayne County, 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.

Year	0 to 17	
	Rate	Count
1990	48.2	2,751
1991	44.4	2,553
1992	47.5	2,743
1993	50.4	2,931
1994	47.6	2,775
1995	63.2	3,703
1996	59.8	3,507
1997	56.5	3,306
1998	41.2	2,397
1999	40.7	2,356
2000	51.4	2,930
2001	46.3	2,644
2002	39.7	2,271

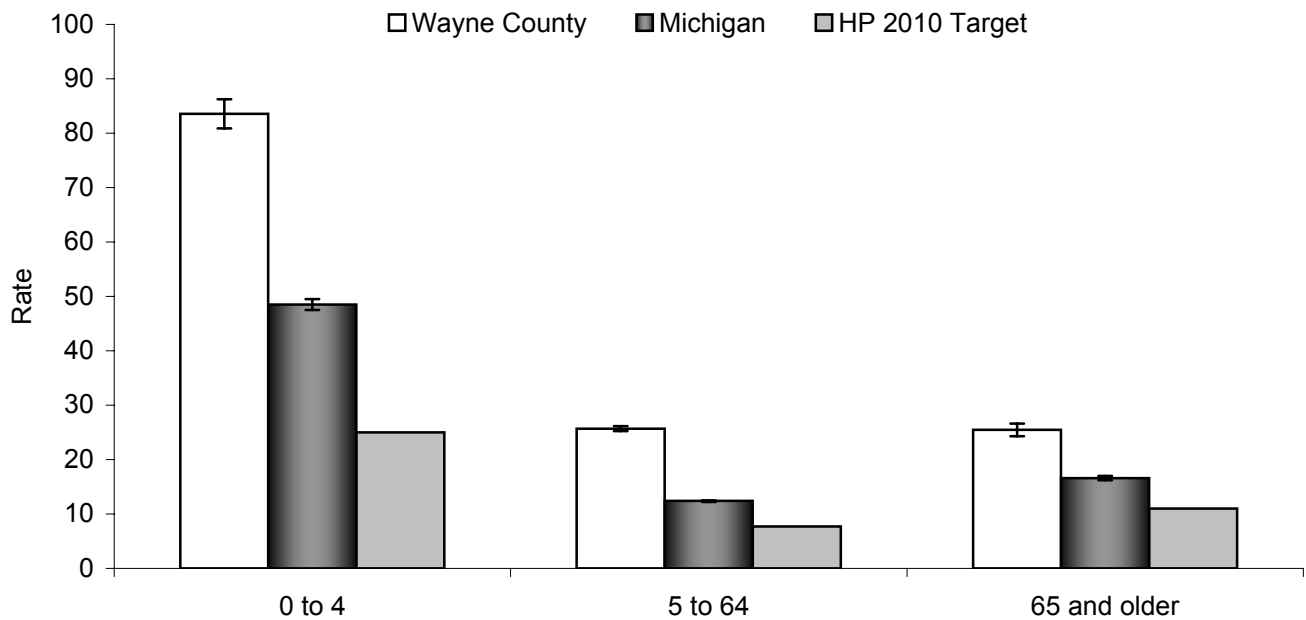
HP 2010 Target	17.3
-----------------------	-------------

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

✧ Between 1990 and 2002, there has not been a significant trend in asthma hospitalization rates for the population aged less than 18 years in Wayne County.

See appendix page 54 for supporting data.

Figure 21. Rates (per 10,000) [1,2] of Hospitalization due to Asthma [3] by Age Group for Wayne County 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.

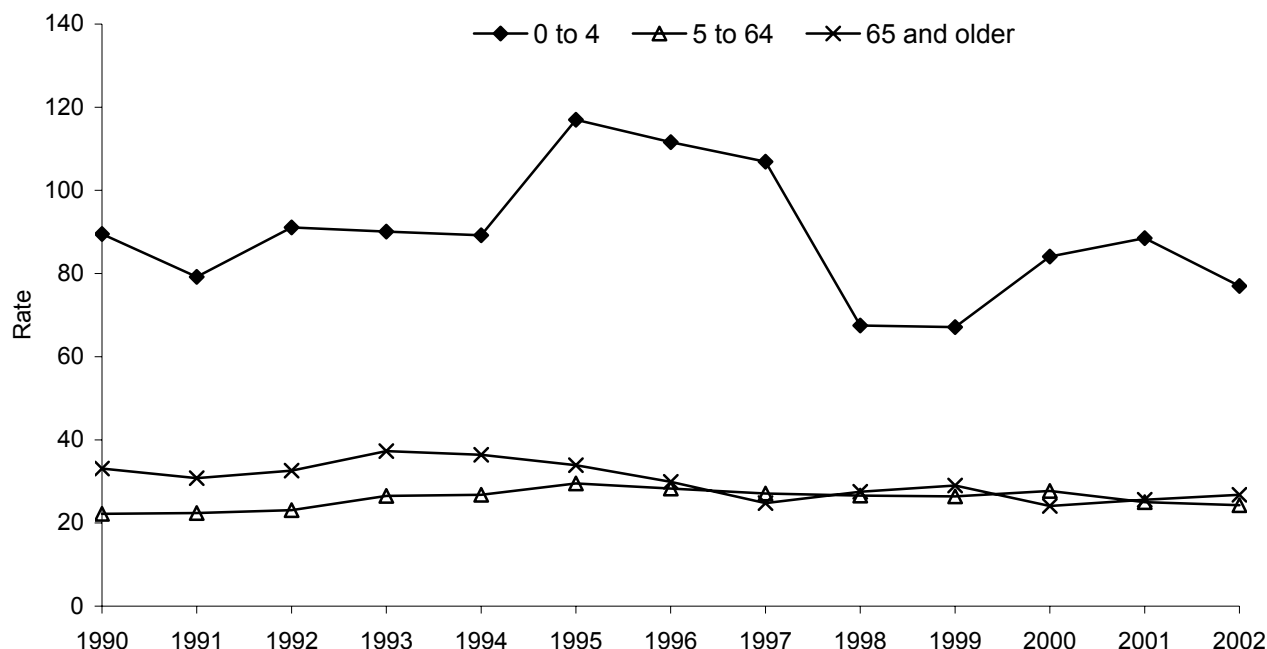
3 Asthma hospitalization is defined as a primary discharge diagnosis of asthma, ICD-9-CM=493.XX.

	0 to 4	5 to 64	65 and Older
Wayne County Rate	83.6	25.7	25.5
95% CI	80.9 , 86.2	25.2 , 26.1	24.3 , 26.6
Count	3,749	12,897	1,879
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.

- ✧ For all age groups, the rates of asthma hospitalization in Wayne County are significantly higher than the respective *Healthy People 2010* Target Rates, 2000-2002.
- ✧ For all age groups, the rates of asthma hospitalization in Wayne County are significantly higher 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 Wayne County, 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.

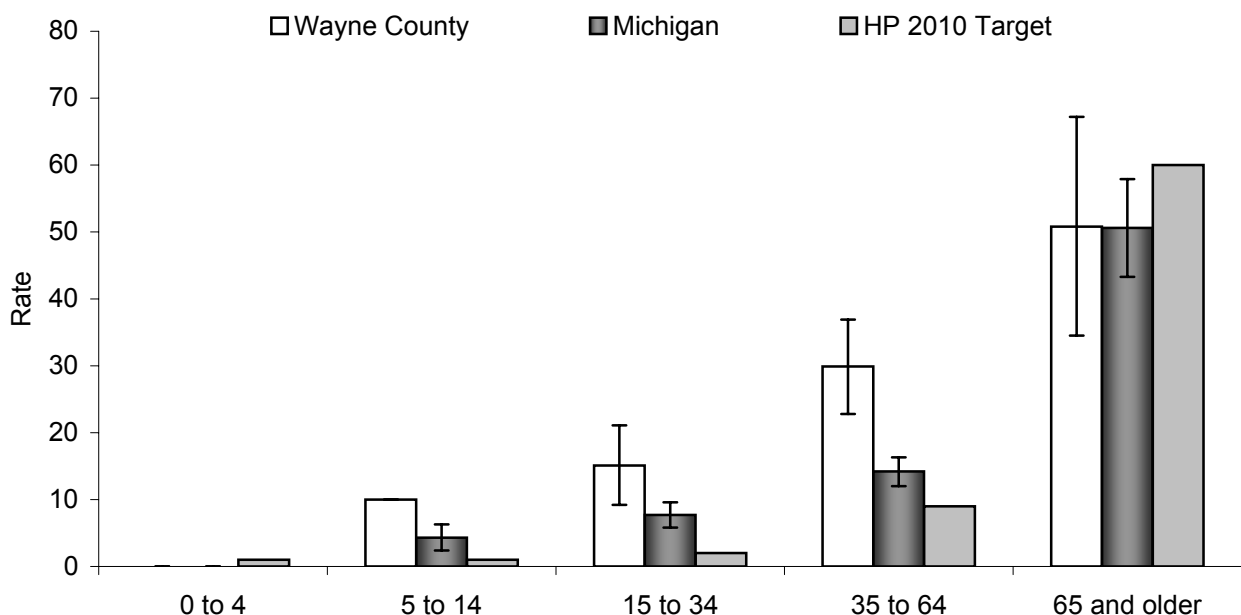
Year	0 to 4		5 to 64		65 and Older	
	Rate	Count	Rate	Count	Rate	Count
1990	89.5	1,554	22.2	3,602	33.1	871
1991	79.2	1,399	22.4	3,626	30.8	832
1992	91.1	1,621	23.1	3,773	32.6	871
1993	90.1	1,603	26.5	4,343	37.3	1,005
1994	89.2	1,559	26.8	4,388	36.4	971
1995	117.0	1,986	29.5	4,939	33.9	903
1996	111.6	1,838	28.3	4,774	29.9	783
1997	106.9	1,713	27.1	4,585	24.8	644
1998	67.5	1,060	26.6	4,462	27.5	699
1999	67.1	1,035	26.4	4,417	29.0	727
2000	84.1	1,263	27.7	4,659	24.1	597
2001	88.5	1,324	25.0	4,194	25.6	631
2002	77.0	1,162	24.3	4,044	26.8	651
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 overall decrease in asthma hospitalization rates among the population aged 65 years and older in Wayne County ($r = -0.75$, $p < 0.01$).

See appendix pages 55 through 57 for supporting data.

Figure 23. Rates (per 1,000,000) [1] of Mortality due to Asthma [2] by Age Group for Wayne County 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.

	0 to 4	5 to 14	15 to 34	35 to 64	65 and Older
Wayne County Rate	‡	10.0	15.1	29.9	50.8
95% CI	‡, ‡	10.0, 10.0	9.2, 21.1	22.8, 36.9	34.5, 67.2
Count	~	10	25	69	37
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 rates of asthma mortality in Wayne County and the State of Michigan are significantly higher than the respective *Healthy People 2010* Target Rates 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 Wayne County and the State of Michigan. It also includes a summary for Wayne 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 Wayne County and the State of Michigan, 1990-2002.

Year	Wayne County		Michigan	
	Rate	Count	Rate	Count
1990	28.3	6,027	19.1	17,790
1991	27.4	5,857	18.1	16,995
1992	29.0	6,265	18.4	17,597
1993	32.3	6,951	19.8	18,975
1994	32.4	6,918	18.4	17,609
1995	36.1	7,828	19.5	18,945
1996	34.3	7,395	18.5	18,058
1997	32.3	6,942	17.7	17,320
1998	29.5	6,221	15.6	15,289
1999	29.6	6,179	15.6	15,385
2000	31.2	6,519	16.0	15,886
2001	29.5	6,149	15.5	15,363
2002	28.3	5,857	14.7	14,696

Spearman's ρ	0.09	-0.79**
-------------------	------	---------

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.

** 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 Wayne County and the State of Michigan, 1990-2002.**

Year	Wayne County		Michigan	
	Rate	Count	Rate	Count
1990	25.0	2,637	17.1	7,951
1991	23.8	2,554	15.7	7,345
1992	24.9	2,714	16.1	7,666
1993	27.9	2,999	16.6	7,929
1994	28.4	3,044	15.4	7,339
1995	32.8	3,584	17.1	8,275
1996	30.5	3,316	15.9	7,725
1997	28.9	3,133	15.4	7,546
1998	25.1	2,655	12.7	6,199
1999	24.5	2,569	12.7	6,229
2000	27.3	2,879	13.7	6,745
2001	24.6	2,562	12.8	6,271
2002	24.1	2,483	12.2	5,971

Spearman's ρ	-0.13	-0.82**
-------------------	-------	---------

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.

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

Sample Interpretation of Annual Rate:

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

Sample Trend Interpretation:

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

Counts and Rates (per 10,000) [1,2] of Asthma [3] Hospitalization [4] by Year for FEMALES, All Ages, for Wayne County and the State of Michigan, 1990-2002.

Year	Wayne County		Michigan	
	Rate	Count	Rate	Count
1990	30.7	3,390	20.6	9,834
1991	30.0	3,303	20.0	9,648
1992	31.9	3,550	20.3	9,927
1993	35.6	3,952	22.6	11,043
1994	35.2	3,874	20.9	10,269
1995	38.3	4,244	21.6	10,668
1996	37.0	4,079	20.8	10,333
1997	34.9	3,809	19.6	9,774
1998	33.0	3,566	18.1	9,089
1999	33.6	3,610	18.1	9,155
2000	34.1	3,640	18.0	9,141
2001	33.5	3,587	17.8	9,092
2002	31.5	3,374	16.9	8,725

Spearman's ρ	0.12	-0.76**
-------------------	------	---------

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.

** 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 Wayne County and the State of Michigan, 1990-2002.

Year	Wayne County		Michigan	
	Rate	Count	Rate	Count
1990	16.3	2,005	15.1	11,791
1991	15.9	1,926	14.2	11,148
1992	15.9	1,938	14.1	11,165
1993	17.0	2,068	14.8	11,757
1994	16.1	1,921	13.2	10,488
1995	16.5	1,951	13.2	10,586
1996	15.1	1,779	12.6	10,140
1997	14.5	1,684	12.2	9,849
1998	12.4	1,436	10.5	8,522
1999	12.5	1,436	10.7	8,716
2000	13.4	1,510	10.8	8,781
2001	12.3	1,388	10.5	8,541
2002	11.2	1,270	9.9	8,133

Spearman's ρ	-0.85**	-0.95**
-------------------	---------	---------

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.

** 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 Wayne County and the State of Michigan, 1990-2002.

Year	Wayne County		Michigan	
	Rate	Count	Rate	Count
1990	45.8	4,006	43.0	5,800
1991	43.7	3,907	41.4	5,715
1992	47.6	4,291	44.4	6,209
1993	53.6	4,839	49.1	6,948
1994	54.8	4,955	48.5	6,858
1995	61.8	5,808	54.0	8,031
1996	59.6	5,562	51.3	7,603
1997	55.7	5,222	48.0	7,246
1998	52.9	4,767	45.3	6,607
1999	52.6	4,701	44.2	6,459
2000	54.3	4,973	45.2	6,888
2001	52.1	4,712	43.2	6,518
2002	50.8	4,529	42.0	6,279

Spearman's ρ	0.23	-0.07
-------------------	------	-------

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.

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 Wayne County and the State of Michigan, 1990-2002.

Year	Wayne County		Michigan	
	Rate	Count	Rate	Count
1990	13.8	819	13.4	5,142
1991	13.0	763	12.0	4,632
1992	12.9	764	12.1	4,715
1993	13.9	807	11.9	4,633
1994	12.4	713	10.4	4,033
1995	13.2	756	10.9	4,285
1996	11.4	652	10.2	4,012
1997	11.7	668	10.1	3,993
1998	9.4	526	8.1	3,198
1999	9.8	542	8.5	3,338
2000	11.4	623	8.9	3,499
2001	9.3	508	8.4	3,284
2002	8.8	483	8.0	3,133

Spearman's ρ	-0.89**	-0.95**
-------------------	---------	---------

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.

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

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 Wayne County and the State of Michigan, 1990-2002.

Year	Wayne County		Michigan	
	Rate	Count	Rate	Count
1990	18.4	1,186	16.5	6,647
1991	18.4	1,163	16.0	6,514
1992	18.4	1,173	15.7	6,446
1993	19.7	1,261	17.3	7,122
1994	19.2	1,208	15.6	6,455
1995	19.4	1,195	15.2	6,301
1996	18.5	1,127	14.8	6,128
1997	17.1	1,016	14.1	5,856
1998	15.2	910	12.7	5,324
1999	15.1	894	12.7	5,378
2000	15.3	887	12.5	5,282
2001	15.0	880	12.4	5,257
2002	13.4	787	11.6	5,000

Spearman's ρ	-0.74**	-0.97**
-------------------	---------	---------

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.

** 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 Wayne County and the State of Michigan, 1990-2002.

Year	Wayne County		Michigan	
	Rate	Count	Rate	Count
1990	41.2	1,812	39.2	2,721
1991	38.8	1,784	36.6	2,660
1992	41.9	1,936	39.0	2,864
1993	47.7	2,175	42.8	3,169
1994	50.6	2,314	43.1	3,176
1995	57.2	2,789	48.6	3,838
1996	55.0	2,639	45.8	3,569
1997	51.0	2,452	43.7	3,452
1998	46.4	2,118	38.3	2,927
1999	44.3	2,009	37.0	2,796
2000	48.0	2,240	39.4	3,147
2001	44.8	2,031	36.6	2,856
2002	44.2	1,965	35.0	2,699

Spearman's ρ	0.24	-0.30
-------------------	------	-------

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.

Sample Interpretation of Annual Rate:

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

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 Wayne County and the State of Michigan, 1990-2002.

Year	Wayne County		Michigan	
	Rate	Count	Rate	Count
1990	48.4	2,194	45.3	3,079
1991	46.2	2,123	44.3	3,055
1992	50.8	2,355	47.8	3,345
1993	57.1	2,664	53.4	3,779
1994	56.8	2,641	51.9	3,682
1995	63.4	3,019	57.1	4,193
1996	61.4	2,923	54.7	4,034
1997	58.0	2,770	50.6	3,794
1998	56.7	2,649	50.0	3,680
1999	57.9	2,692	49.4	3,663
2000	58.0	2,733	49.0	3,741
2001	56.9	2,681	48.0	3,662
2002	54.9	2,564	47.0	3,580

Spearman's ρ	0.39	0.08
-------------------	------	------

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.

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 Wayne County and the State of Michigan, 1990-2002.

Year	Wayne County		Michigan	
	Rate	Count	Rate	Count
1990	89.5	1,554	66.1	4,712
1991	79.2	1,399	57.1	4,106
1992	91.1	1,621	64.4	4,638
1993	90.1	1,603	59.6	4,291
1994	89.2	1,559	53.2	3,783
1995	117.0	1,986	63.9	4,457
1996	111.6	1,838	59.6	4,092
1997	106.9	1,713	59.2	4,019
1998	67.5	1,060	40.5	2,734
1999	67.1	1,035	40.6	2,725
2000	84.1	1,263	48.8	3,257
2001	88.5	1,324	50.5	3,341
2002	77.0	1,162	45.8	3,039

Spearman's ρ	-0.42	-0.76**
-------------------	-------	---------

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.

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

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 Wayne County and the State of Michigan, 1990-2002.

Year	Wayne County		Michigan	
	Rate	Count	Rate	Count
1990	33.2	1,006	20.9	2,826
1991	32.4	995	19.4	2,666
1992	30.7	948	18.5	2,571
1993	35.7	1,118	21.1	2,972
1994	32.7	1,037	17.1	2,418
1995	45.8	1,482	21.9	3,152
1996	44.2	1,455	21.4	3,113
1997	42.7	1,423	22.1	3,244
1998	35.2	1,184	16.8	2,491
1999	34.6	1,171	16.8	2,497
2000	43.9	1,464	20.4	3,010
2001	35.0	1,169	16.0	2,363
2002	29.3	973	13.7	2,002

Spearman's ρ	0.15	-0.48
-------------------	------	-------

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.

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 Wayne County and the State of Michigan, 1990-2002.

Year	Wayne County		Michigan	
	Rate	Count	Rate	Count
1990	13.7	918	9.1	2,709
1991	13.5	887	8.9	2,628
1992	15.2	986	9.8	2,839
1993	17.4	1,108	11.7	3,352
1994	17.5	1,091	10.9	3,081
1995	20.9	1,290	11.8	3,341
1996	19.0	1,165	11.5	3,220
1997	17.9	1,073	10.6	2,959
1998	19.1	1,123	10.0	2,755
1999	17.1	990	9.2	2,526
2000	17.8	1,019	9.2	2,502
2001	15.8	885	8.2	2,253
2002	15.6	858	7.7	2,104

Spearman's ρ	0.32	-0.31
-------------------	------	-------

- 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.

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 Wayne County and the State of Michigan, 1990-2002.

Year	Wayne County		Michigan	
	Rate	Count	Rate	Count
1990	24.1	1,678	14.8	4,694
1991	24.8	1,744	15.0	4,838
1992	25.7	1,839	14.5	4,795
1993	29.4	2,117	15.9	5,369
1994	31.1	2,260	16.0	5,509
1995	29.5	2,167	15.6	5,493
1996	28.9	2,154	15.0	5,401
1997	27.9	2,089	13.8	5,065
1998	28.8	2,155	14.2	5,275
1999	30.1	2,256	14.7	5,547
2000	28.8	2,176	13.6	5,264
2001	28.0	2,140	13.8	5,383
2002	28.7	2,213	13.5	5,317

Spearman's ρ	0.28	-0.70**
-------------------	------	---------

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.

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

Sample Interpretation of Annual Rate:

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

Sample Trend Interpretation:

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

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

Year	Wayne County		Michigan	
	Rate	Count	Rate	Count
1990	33.1	871	25.7	2,849
1991	31.4	832	24.4	2,757
1992	32.7	871	23.9	2,754
1993	37.7	1,005	25.6	2,991
1994	36.6	971	23.8	2,818
1995	34.1	903	20.9	2,502
1996	29.8	783	18.5	2,232
1997	24.9	644	16.8	2,033
1998	27.6	699	16.8	2,034
1999	29.0	727	17.2	2,090
2000	24.0	597	15.2	1,853
2001	25.7	631	16.5	2,023
2002	26.8	651	18.1	2,234

Spearman's ρ	-0.75**	-0.88**
-------------------	---------	---------

- 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.

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

Sample Interpretation of Annual Rate:

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

Sample Trend Interpretation:

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

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

Year	Wayne County		Michigan	
	Rate	Count	Rate	Count
1990	46.2	2,751	31.7	8,063
1991	42.5	2,553	28.3	7,254
1992	45.0	2,743	29.9	7,735
1993	48.1	2,931	30.5	7,875
1994	45.6	2,775	26.2	6,757
1995	61.2	3,703	31.9	8,221
1996	58.4	3,507	30.2	7,769
1997	55.6	3,306	30.1	7,742
1998	40.7	2,397	21.8	5,594
1999	40.3	2,356	21.6	5,546
2000	51.1	2,930	26.3	6,693
2001	46.4	2,644	24.1	6,089
2002	39.9	2,271	21.3	5,359

Spearman's ρ	-0.14	-0.68*
-------------------	-------	--------

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.

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

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 Wayne County and the State of Michigan, 1990-2002.

Year	Wayne County		Michigan	
	Rate	Count	Rate	Count
1990	22.0	3,276	14.7	9,727
1991	22.1	3,304	14.5	9,741
1992	23.4	3,522	14.5	9,862
1993	26.8	4,020	16.1	11,100
1994	27.8	4,143	15.7	10,852
1995	27.4	4,125	15.2	10,724
1996	25.9	3,888	14.5	10,289
1997	24.2	3,636	13.3	9,578
1998	25.7	3,824	13.4	9,695
1999	25.8	3,823	13.5	9,839
2000	24.2	3,589	12.5	9,193
2001	23.6	3,505	12.5	9,274
2002	24.2	3,586	12.5	9,337

Spearman's ρ	0.17	-0.80**
-------------------	------	---------

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.

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

Sample Interpretation of Annual Rate:

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

Sample Trend Interpretation:

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

Wayne County

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

		Count	Rate	95% Confidence Interval	
				Lower Limit	Upper Limit
Total Population		18,525	29.7	29.2	30.1
Sex	Male	7,924	25.4	24.8	26.0
	Female	10,601	33.1	32.4	33.7
Race ⁵	White	4,168	12.3	12.0	12.7
	Black	14,214	52.5	51.6	53.4
Sex and Race ⁵	White Male	1,614	9.9	9.4	10.3
	White Female	2,554	14.6	14.0	15.1
	Black Male	6,236	45.8	44.6	47.0
	Black Female	7,978	56.7	55.4	57.9
Age (unadjusted)	0-4 Years	3,749	83.6	80.9	86.2
	5-14 Years	3,606	36.0	34.8	37.2
	15-34 Years	2,762	16.4	15.8	17.0
	35-64 Years	6,529	28.5	27.8	29.2
	65+ Years	1,879	25.5	24.3	26.6
Age	<18 Years	7,845	45.9	44.9	46.9
	18+ Years	10,680	24.0	23.5	24.5

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

		Count	Rate	95% Confidence Interval	
				Lower Limit	Upper Limit
Age	0-4 Years ⁶	3,749	83.6	80.9	86.2
	5-64 Years	12,897	25.7	25.2	26.1
	65+ Years	1,879	25.5	24.3	26.6
	<18 Years ⁶	7845	45.8	44.8	46.8

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

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

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

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

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

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

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

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

Year	Wayne County		Michigan	
	Rate	Count	Rate	Count
1990	26.5	52	18.4	159
1991	24.1	49	20.5	179
1992	29.3	56	18.8	165
1993	31.2	63	22.0	196
1994	28.2	57	21.1	193
1995	31.3	64	23.1	216
1996	31.4	64	20.4	190
1997	23.1	46	18.2	171
1998	35.1	70	22.7	217
1999	27.4	55	16.6	162
2000	28.7	57	16.7	164
2001	27.9	55	15.4	153
2002	28.7	58	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 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.

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 Wayne County and the State of Michigan, 1990-2002, Compared to the Healthy People 2010 Target (Objective 1-9a).

Year	HP 2010 Objective	Wayne County		Michigan	
		Rate	Count	Rate	Count
1990	17.3	48.2	2,751	32.8	8,063
1991	17.3	44.4	2,553	29.2	7,254
1992	17.3	47.5	2,743	30.9	7,735
1993	17.3	50.4	2,931	31.2	7,875
1994	17.3	47.6	2,775	26.6	6,757
1995	17.3	63.2	3,703	32.1	8,221
1996	17.3	59.8	3,507	30.1	7,769
1997	17.3	56.5	3,306	30.0	7,742
1998	17.3	41.2	2,397	21.7	5,594
1999	17.3	40.7	2,356	21.4	5,546
2000	17.3	51.4	2,930	26.0	6,693
2001	17.3	46.3	2,644	23.7	6,089
2002	17.3	39.7	2,271	20.8	5,359

Spearman's ρ	-0.29	-0.79**
-------------------	-------	---------

- 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.

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

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 Wayne County and the State of Michigan, 1990-2002, Compared to the Healthy People 2010 Target (Objective 24-2).

Year	HP 2010 Objective	Wayne County		Michigan	
		Rate	Count	Rate	Count
1990	25.0	89.5	1,554	66.1	4,712
1991	25.0	79.2	1,399	57.1	4,106
1992	25.0	91.1	1,621	64.4	4,638
1993	25.0	90.1	1,603	59.6	4,291
1994	25.0	89.2	1,559	53.2	3,783
1995	25.0	117.0	1,986	63.9	4,457
1996	25.0	111.6	1,838	59.6	4,092
1997	25.0	106.9	1,713	59.2	4,019
1998	25.0	67.5	1,060	40.5	2,734
1999	25.0	67.1	1,035	40.6	2,725
2000	25.0	84.1	1,263	48.8	3,257
2001	25.0	88.5	1,324	50.5	3,341
2002	25.0	77.0	1,162	45.8	3,039

Spearman's ρ	-0.42	-0.76**
-------------------	-------	---------

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.

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

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 Wayne County and the State of Michigan, 1990-2002, Compared to the Healthy People 2010 Target (Objective 24-2).

Year	HP 2010 Objective	Wayne County		Michigan	
		Rate	Count	Rate	Count
1990	7.7	22.2	3,602	14.0	10,229
1991	7.7	22.4	3,626	13.7	10,132
1992	7.7	23.1	3,773	13.6	10,205
1993	7.7	26.5	4,343	15.5	11,693
1994	7.7	26.8	4,388	14.5	11,008
1995	7.7	29.5	4,939	15.5	11,986
1996	7.7	28.3	4,774	15.0	11,734
1997	7.7	27.1	4,585	14.2	11,268
1998	7.7	26.6	4,462	13.2	10,521
1999	7.7	26.4	4,417	13.2	10,570
2000	7.7	27.7	4,659	13.3	10,776
2001	7.7	25.0	4,194	12.3	9,999
2002	7.7	24.3	4,044	11.5	9,423

Spearman's ρ	0.31	-0.63*
-------------------	------	--------

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.

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

Sample Interpretation of Annual Rate:

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

Sample Trend Interpretation:

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

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

Year	HP 2010 Objective	Wayne County		Michigan	
		Rate	Count	Rate	Count
1990	11.0	33.1	871	25.8	2,849
1991	11.0	30.8	832	24.3	2,757
1992	11.0	32.6	871	23.9	2,754
1993	11.0	37.3	1,005	25.5	2,991
1994	11.0	36.4	971	23.9	2,818
1995	11.0	33.9	903	20.9	2,502
1996	11.0	29.9	783	18.6	2,232
1997	11.0	24.8	644	16.8	2,033
1998	11.0	27.5	699	16.8	2,034
1999	11.0	29.0	727	17.2	2,090
2000	11.0	24.1	597	15.2	1,853
2001	11.0	25.6	631	16.5	2,023
2002	11.0	26.8	651	18.1	2,234

Spearman's ρ	-0.75**	-0.87**
-------------------	---------	---------

- 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.

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

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.

References

Hennekens CH. And Buring JE. Ed. Mayrent SL. *Epidemiology in Medicine*. Boston, MA: Little, Brown, and Company, 1987.

Hollander M and Wolfe DA. *Nonparametric Statistical Methods, Second Edition*. New York: John Wiley & Sons, Inc., 1999

Klein RJ and Schoenborn CA. Healthy People 2010: *Age Adjustment Using the 2000 Projected U.S. Population*. Statistical Notes (20). Department of Health and Human Services. Centers for Disease Control and Prevention, National Center for Health Statistics. January 2001, (<http://www.cdc.gov/nchs/data/statnt/statnt20.pdf>).

Rothman KJ and Greenland S. *Modern Epidemiology, Second Edition*. Philadelphia: Lippincott-Raven Publishers, 1998.

Szklo M and Nieto FJ. *Epidemiology Beyond the Basics*. Gaithersburg, MD: Aspen Publishers, Inc., 2000.