

2001

**Annual Report on
Work-Related Asthma
in Michigan**



2001 Annual Report on Work-Related Asthma in Michigan

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Summary:

This is the eleventh annual report on work-related asthma (WRA) in Michigan. An average of 146 new people each year are reported to the Michigan Department of Consumer and Industry Services (MDCIS) with asthma caused or aggravated by exposures in the workplace. From 1988 to 2001, a total of 1,782 people with WRA have been identified through the Michigan Surveillance System that tracks occupational illness. Yet we know this is an under-representation of the true number of individuals with WRA in our state.

There are a number of ways to estimate the extent of WRA in a given population, ranging from the use of self-reports from surveys, to statistical estimates from studies, to an actual census count of disease. In the year 2001, one Michigan survey called the Behavioral Risk Factor Surveillance System (BRFSS), which is administered through the Michigan Department of Community Health (MDCH) included specific questions about WRA. For 2001, the BRFSS estimated there are 650,000 adults in Michigan with asthma. Further, the BRFSS found that approximately 10% of the survey respondents reported that either they told their doctor or their doctor told them that their asthma was work-related. Based on this response, approximately 65,000 Michigan adults would have work-related asthma.

The medical literature suggests an even higher percentage of adult asthma is work-related, 15% (1). Applying this percentage to the BRFSS estimate of 650,000 Michigan adults with asthma would translate into approximately 97,000 adults in Michigan with work-related asthma.

Using a technique called capture-recapture, another estimate of the extent of work-related asthma in Michigan suggests that the average of 146 reports received by the MDCIS each year represents 18.2% - 64.0% (228-801) of the true number of adults who develop new onset asthma caused by exposure at work (2). All of these methods to estimate the magnitude of work-related asthma in Michigan indicate that WRA is a significant problem in our state.

Work place exposures may cause new onset asthma from exposure to an allergen or an irritant that precipitates inflammatory changes, or work exposures may exacerbate pre-existing asthma from exposure to an irritant. Almost ninety percent of the reports received in Michigan involve the new onset of asthma. Michigan Occupational Safety and Health Act (MIOSHA) enforcement inspections at the workplaces of these individuals reveal a large number of fellow workers with asthma or respiratory symptoms compatible with asthma.

There are over 380 documented agents or work processes associated with work-related asthma. The most comprehensive listing of known causes of work-related asthma can be found on the internet at: www.remcomp.com/asmanet/asmapro/asmawork.htm#star. Known allergens such as isocyanates and metal working fluids are the most commonly reported cause of work-related asthma in Michigan, representing 17.1% and 12.1% of the Michigan WRA cases, respectively. However, despite the association of a patient's asthma with work, many times a known allergen is not identified. A high level of clinical suspicion for new causes of work-related asthma, therefore, is warranted among the State's health practitioners when evaluating a patient for lung disease.

Work-related asthma is affecting men and women, generally in the 30-50 year old age range.

The average annual incidence rate of work-related asthma among African Americans was 2.1 times greater than among whites. Exposures are occurring in a wide range of workplaces. When an inspection is conducted at the workplace, significant numbers of symptomatic individuals have been identified. However, air monitoring at these same facilities typically reveals that the exposures to the suspected allergen or irritant are within existing workplace standards (94% of time). In 28% of the companies a specific Michigan Occupational Safety and Health Act (MIOSHA) workplace standard for the suspected allergen or irritant does not exist.

This past year, the Michigan WRA surveillance team began working on three new initiatives. In addition to Michigan, three states have developed surveillance systems for work-related asthma. An in-depth analysis of information related to cleaning agent exposures that the four states conducting surveillance of WRA have collected is nearing completion. By combining the data on cleaning agent exposures from the four states that track work-related asthma (California, Massachusetts, Michigan and New Jersey) we will be able to describe the characteristics and trends of workers who develop asthma from these types of exposures.

The second initiative is also a collaborative effort among the four states that track work-related asthma. Similar to the cleaning agent initiative, the states' surveillance teams are evaluating asthma among health care workers. Health care workers are exposed to a number of well-documented allergens such as latex, glutaraldehyde in sterilizing/cleaning solutions, and methylmethacrylate glue used in orthopedic surgical procedures. Again, by combining the data from the four states we will be able to describe the nature and extent of WRA among health care workers.

The third initiative we began working on this past year is a Local Emphasis Program (LEP) for workers exposed to welding fume. The Michigan surveillance team has begun collecting information obtained during MIOSHA enforcement inspections to better understand the types of welding fume exposures and work practices associated with WRA. Within the next year we expect to complete a sufficient number of inspections under this LEP in order to conduct at least a preliminary analysis of the data. All three initiatives were specifically undertaken because these exposures account for a significant number of the work-related asthma cases identified through the surveillance systems years of tracking this disease.

Background:

In 1988, the Michigan Department of Consumer and Industry Services (formerly the Michigan Department of Public Health) instituted a surveillance program for work-related asthma with financial assistance from the National Institute for Occupational Safety and Health (NIOSH). The goal of the surveillance program is to prevent work-related asthma through the reporting of index patients. The reporting of the index patient is regarded as a sentinel health event that may lead to the identification of other employees from the same facility who are at risk of developing asthma or who have developed similar breathing problems. There are three sources used to identify persons with work-related asthma: reports from physicians; reports from hospitals (since 1989); and claims filed since 1988 with the Bureau of Workers' Compensation. Both physicians in private practice and those working for industry send reports to the Michigan Department of Consumer and Industry Services (MDCIS). Reports from hospitals are requested once each year. Hospital discharge summaries for individuals with a primary or secondary

diagnosis of a respiratory condition due to chemical fumes and vapors (ICD-9 506.0-.9) as well as individuals with a primary or secondary diagnosis of asthma (ICD-9 493) where the principal payer is listed as workers' compensation are obtained from the Michigan Health and Hospital Association's (MHA) Michigan inpatient database to verify the completeness of reporting by the hospitals, so that the work-relatedness of the condition can be determined.

A person is considered to have work-related asthma from sensitization to a workplace exposure if: A) they have a physician diagnosis of asthma, B) onset of respiratory symptoms associated with a particular job that then improve or are relieved when the patient is not working, and C) they work with a known occupational allergen, or have evidence of an association between work exposures and a decrease in pulmonary function testing.

Additional criteria are used to record three other categories of asthma associated with work. If only criteria (A) and (B) above are met the person is considered to have possible work-related asthma. An enforcement industrial hygiene investigation at the patient's work site is conducted by MIOSHA to determine the allergen and to document its associated exposure levels. If a person had physician-diagnosed asthma before beginning work and their asthma became worse at a particular job the person is considered to have work-aggravated asthma. Occupational asthma from exposure to an allergen at work typically develops after a variable period of symptomless exposure to the sensitizing agent. However, if a person develops asthma for the first time immediately after an acute exposure to an irritating chemical at work the patient is considered to have Reactive Airways Dysfunction Syndrome (RADS) (3).

After the patient is interviewed and the work-relatedness of the condition evaluated, an industrial hygiene investigation may be conducted at the patient's workplace. At this follow-up investigation, co-workers are interviewed to determine if other individuals are experiencing similar breathing problems from exposure to the suspected allergen. An industrial hygienist conducts air monitoring for any suspected allergens and reviews the company's health and safety program. After the investigation is completed, a report of air sampling results and any recommendations are sent to the company and union (or designated labor representative, if the company does not have a union).

In 1998, the surveillance program also began sending letters about potential problems with exposures to some of the companies where the index cases were exposed to an allergen, in cases where a formal MIOSHA inspection was not planned. These letters, in lieu of inspections, are sent to the company health and safety director, and ask the company to evaluate exposures to whatever suspected allergens were identified through the telephone interview with the index case.

Results:

Reports

Table 1 shows that 1,782 people were confirmed with work-related asthma between 1988 - 2001. Figure 1 presents the same data in a bar graph of the number of cases identified each year, and the types of work-related asthma that were confirmed. The reports are divided into four categories: occupational asthma, possible occupational asthma, aggravated asthma and RADS.

One hundred forty-one additional patients have been confirmed since last year's report. Figure 2 shows the overlap of the 1,702 patients by reporting sources for the years 1988-2000.

The data is incomplete for 1988 since the surveillance system was initiated in that year. To date we have not yet received complete hospital reporting for the years 2000 and 2001. Patient interviews are still needed for 6 reports of patients from hospitals in 2000; and, for 29 reports of patients from hospitals and for 14 reports of patients from physicians in 2001.

Gender

Nine hundred seven (49.1%) of the persons with work-related asthma are women and 875 (50.9%) are men.

Race

One thousand three hundred sixty-one (76.8%) of the persons with work-related asthma are white, 330 (18.6%) are African American, 41 (2.3%) are Hispanic, 16 (0.9%) are Alaskan or American Indian, 6 (0.3%) are Asian, and 17 (1.0%) were listed as "other." For eleven individuals, race was unknown.

The average number of incident cases of African Americans with work-related asthma each year for 1992-1999 was 29. In 1998 there were 539,621 African Americans in the Michigan labor force (4). The annual incidence rate for work-related asthma in African Americans, therefore, was 5.4/100,000 workers. The respective data for whites was 115 new cases per year and 4,368,720 whites in the Michigan labor force. The annual incidence rate of work-related asthma in whites, therefore, was 2.6/100,000 workers. The African American rate of work-related asthma was 2.1 times greater than the rate for whites.

Age

The dates of birth range from 1905 - 1980. The average year of birth is 1953.

Location in State

Figure 3 shows the county in which the patient worked where they developed work-related asthma. The main locations are: Wayne (460 cases, 26.3%), Oakland (237 cases, 13.5%), and Macomb (174 cases, 9.9%). Table 2 and Figure 4 show the annual average incidence rates of work-related asthma among the general working population in each county. Based on the annual average incidence of reports of confirmed cases per 100,000 adult workers, Luce (21.1 per 100,000), Clare (12.5 per 100,000), Osceola (11.3 per 100,000), and Cheboygan (10.4 per 100,000) have the highest rates. It should be noted that, even though Luce county had the highest incidence rate of work-related asthma, the rate is based on only five cases (see Table 2). Table 3 shows the annual incidence rates for the larger metropolitan areas and the whole state for the years 1990 through 1999 separately.

Type of Industry

Table 4 shows the types of Michigan industries where the exposures to the occupational allergens occurred from 1988 to 2001. Figure 5 shows the distribution of major industry types for all cases identified from 1988-2001. The predominant industries for the total number of cases identified between 1988 and 2001 were in the manufacturing sector: automobile (43.5%), fabricated metal products (4.2%), rubber and miscellaneous plastic products (3.8%), industrial and commercial machinery and computer equipment (4.0%), and foundries (3.3%). Workers in the health field also accounted for a high percentage of the total number of patients (8.8%).

The incidence rate of work-related asthma by industry type ranges from 0.3 cases per 100,000 in restaurants to a high of 20.7 cases per 100,000 in the manufacture of transportation equipment. The industries with the highest annual average incidence rates besides the manufacture of transportation equipment included: foundries with 12.5 cases per 100,000 workers; the manufacture of other nondurables with 11.2 cases per 100,000 workers; and the manufacture of rubber products with 9.1 cases per 100,000 workers.

Table 5 shows the annual incidence rates for the 1990 through 1999 work-related cases within those industries which had 20 or more reports.

Overall, by broad industrial classification, the average annual incidence rates were: 10.9 cases per 100,000 workers in the manufacturing industry; 2.6 cases per 100,000 workers in the construction and mining industry; and 0.8 cases per 100,000 workers in the service producing industry.

Table 6 shows the predominant exposures causing work-related asthma in Michigan. The most frequent exposures were to isocyanates (17.1%), metal working fluids (12.1%), vehicle exhaust (5.7%), welding fumes (5.1%), and solvents (3.0%). The agent has not yet been identified for 240 patients (13.5%). The exposures to unknown agents occurred 129 times in the manufacturing sector and 111 times in an office setting.

Medical Results

Table 7 shows patients' cigarette smoking status. Twenty percent of patients were smoking when their work-related asthma developed. This is a lower percentage than the state average and markedly lower than that found in a blue collar working population.

Forty-two percent of the work-related asthma patients had a family history of allergies (Table 8).

Forty-five percent of the asthma patients had a personal history of allergies or asthma (Table 9). Three hundred twenty (41.7%) of the 768 patients with a personal history of allergies or asthma previously had asthma.

One thousand four hundred forty of the patients identified with work-related asthma had persistence of their asthma symptoms (Table 10). This was true for 490 of 516 (95.0%) of those still exposed as well as 950 of 1,130 (84.1%) no longer exposed to the substance causing their asthma. Among those no longer exposed, 50.4% stated their symptoms were less severe compared to 32.6% among those still exposed who reported their symptoms were less severe.

Similarly, 85.1% of those still exposed were continuing to take asthma medications while 76.7% of those no longer exposed were still taking asthma medications. Among those no longer exposed, 29.7% stated they were taking fewer medications while only 20.7% of those still exposed were taking fewer medications (Table 10).

Seven hundred fifty-seven of 1,612 (47.0%) patients with known workers' compensation status had applied for workers' compensation. Cases were pending for 385 (50.9%) of those who applied, while 259 (34.2%) had received awards and 113 (14.9%) had been denied.

Although 1,782 individuals were confirmed with work-related asthma, we could find objective testing for hyperreactivity by methacholine challenge or pre- and post-bronchoprovocation for 57% of cases. In addition, we found only <1% of cases had specific antigen bronchoprovocation, 4% of cases had peak flow monitoring and only 3% of cases had pre- and post-work shift testing.

Industrial Hygiene

The 1,782 people with work-related asthma worked at 1,197 different facilities. Four hundred seventy-five facilities were inspected 537 times. Sixty-two of the 1,197 facilities were inspected more than once. Twenty-four inspections were completed since last year's report. Inspections are scheduled at 11 (0.9%) facilities (Table 11) and three received letters notifying them that a disease report had been received and asked them to investigate potential exposures causing the respiratory problem, including indoor air problems.

Air sampling for allergens was conducted during 384 of the inspections. Fifty-four of the 384 (14.1%) facilities were above the National Institute for Occupational Safety and Health recommended exposure limit (REL). Twenty-four of the 384 (6.3%) were above the enforceable Michigan Occupational Safety and Health Act (MIOSHA) permissible exposure limit (PEL) (Table 12).

Interviews of fellow workers were performed at 412 of the 537 inspections. Workers had daily or weekly breathing symptoms or onset of new asthma since beginning to work at that company in 293 of the 412 (71.5%) companies. The average percentage of workers with symptoms in these 293 companies was 21.0%, ranging from 2% to 100%. Interviews conducted in 119 companies found no co-workers with symptoms. One thousand three hundred and fifteen of the 7,662 (17.2%) fellow workers interviewed had symptoms consistent with work-related asthma (new onset asthma or bothered at work by daily or weekly shortness of breath, wheezing or chest tightness) (Table 13).

Five hundred four workers from 99 companies were listed by employers on the Michigan Occupational Safety and Health Act (MIOSHA) Injury and Illness log as having asthma or asthma-like symptoms. Eight workers had both daily or weekly breathing symptoms and were also listed on the Michigan OSHA log. Therefore, a total of 1,811 symptomatic workers were identified during the 537 inspections.

Proportion of Asthma Attributed to Work

For the year 2001, as part of the Behavioral Risk Factor Surveillance System (BRFSS), an asthma module was included in the Michigan survey. The BRFSS is a random-digit-dialed telephone survey of the civilian, non-institutionalized population ages ≥ 18 years that is administered by states throughout the country. Core questions such as cigarette usage are administered in each state and then states can elect to add modules. Preliminary results from the asthma module from the 2001 BRFSS survey in Michigan are shown in Table 14. The results in Table 14 are based on the response to the following two questions: "Have you ever been told by a doctor, nurse or other health professional that you had asthma?" and "Do you still have asthma?" Almost 9% of adults in Michigan indicate they currently have asthma.

Table 15 shows the results of two questions about work-related asthma: "Were you ever told by a doctor or other medical person that your asthma was related to any job you ever had?"; and "Did you ever tell a doctor or other medical person that your asthma was related to any job you ever had?" Among individuals who currently have asthma and their asthma began as an adult, 20.1% of the men and 9.9% of the women answered yes to at least one of the two questions about the work-relatedness of asthma. For men the percentage who said they told a health care professional their asthma was related to a job was over twice as high as the men who reported that a health care provider said their asthma was work-related (18.0% vs. 7.7%).

The 2000 year census counted 9,938,444 people in Michigan of whom 7,344,510 were 18 years or older. Applying the most recent BRFSS data, that 8.8% of Michigan adults currently have asthma would translate into 646,317 adults in Michigan who have asthma. The Michigan BRFSS survey suggests that there is an association with work in 9.7% (95 %CI 6.7-12.9) of the Michigan adults who currently have asthma (Table 15). This translates into 62,693 (95% CI 43,303-83,375) adults with asthma in Michigan where the healthcare provider or the patient report an association with work. If a male develops asthma as an adult, the latest data from BRFSS suggests that either he or his health care provider will attribute the new onset asthma as work-related 20% of the time. Estimates from the published literature on the percentage of adult asthma which is work-related range from 2-45% with a median of 9%. Calculation of the estimate using the most methodologically sound articles would suggest that 15% of adult asthma is work-related (1).

Discussion:

In our previous annual reports, we have emphasized the fact that the cases reported in Michigan's surveillance system are likely an under count of the true number of cases of work-related asthma in the state. This continues to be true. Studies suggest that work exposures are important etiologic agents in a significant percentage (15%) of adults with asthma (1).

An average of 146 new people each year are reported to the Michigan Department of Consumer and Industry Services (MDCIS) with confirmed work-related asthma. Based on responses from the 2001 BRFSS random sample of Michigan residents, we would estimate that there are a total of 62,693 (43,303 - 83,375) Michigan adults with work-related asthma in the state. Based on the medical literature we would estimate that there are 97,500 Michigan adults with work-related

asthma (1). Using capture-recapture analysis we estimate 228 - 801 adults in Michigan develop work-related asthma each year (2).

As in the previous annual reports on work-related asthma in Michigan, the workers reported are generally young to middle age white men and women, with the greatest number being reported from the Detroit metropolitan area. However, the rate of work-related asthma in African Americans is 2.1 times greater than among whites. We are planning to examine the reason(s) for this difference in this coming year. The people typically develop their asthma from exposures to agents in the manufacturing sector, particularly automobiles, machinery, metals, chemicals, and rubber and plastics. The predominant causes of work-related asthma remain isocyanates (17.1%) and metal-working fluids (12.1%).

Asthma symptoms persist despite removal from the precipitating work exposures (Table 10). Studies have shown that the sooner an individual is removed from the exposure causing their asthma after symptoms develop, the more likely the individual's symptoms will resolve (5). On the average among the 1,130 individuals no longer exposed, 2.7 years elapse from time of onset of respiratory symptoms at work to date last exposed. We do not have data on how much of this delay is secondary to the individual not seeking medical care and how much is related to the physician not recommending that the individual leave the exposure.

Neither personal habits such as cigarette smoking nor individual susceptibility as measured by personal or family history of allergies are predictive of who will develop work-related asthma. Approximately 50% of the asthma patients have no personal or family history of allergies and 80% are not smoking cigarettes at the time their asthma symptoms develop (Tables 7-9).

Although most facilities where the patient developed asthma were not in violation of exposure standards, there were high percentages of symptomatic fellow workers in facilities using occupational allergens. We identified 1,315 fellow workers with symptoms compatible with work-related asthma. Five hundred four individuals were listed on the Michigan OSHA log as having work-related asthma. There was only an overlap of eight individuals, although one might expect a greater overlap of the co-workers with symptoms to be reported on the log. Part of the reason for the lack of overlap is that half of the symptomatic individuals indicate they have never seen a doctor for their respiratory symptoms. This indicates the need for more companies to implement medical surveillance programs. The high percentages of symptomatic individuals are consistent with estimates of the prevalence of work-related asthma in the state. The presence of symptomatic co-workers suggests that some of the occupational health standards may not be sufficiently protective to ensure a safe workplace.

Reevaluations of some of the allowable exposure standards may be needed. These reevaluations might consider comprehensive workplace controls which address not only daily average exposures but exposures during spills and leaks and provision of medical surveillance for potentially exposed workers. Medical monitoring is particularly relevant to reducing the burden of work-related causes of asthma. The longer a person with symptoms remains exposed, the more likely their asthma will become a chronic problem (5). The percentages of individuals reported with work-related asthma for whom this surveillance system could document as having had breathing tests performed in relation to work is less than 10%. This reflects the standard of medical care in the United States where the diagnosis of work-related asthma is made from patient history. More frequent use of objective pulmonary function testing performed in relation

to work would allow health care providers to feel more confident about advising their patients to leave their exposure. Cessation of exposure is the most important aspect of treatment of work-related asthma. Patients who are removed from exposure the soonest have the best prognosis (5).

The Michigan Department of Community Health has released a planning document for a new effort to reduce Michigan's asthma burden, the Michigan Asthma Strategic Planning Initiative (MASPI). One major outcome of this initiative is the development of a comprehensive website of resources on asthma called the Michigan Asthma Communication Network. The web site can be accessed at: www.getasthmahelp.com. Information on work-related asthma has been included on this web site. Given the potential that 15% or more of adults with asthma have work-related asthma, work-related asthma needs to be integrated into all asthma initiatives planned on surveillance and education, both for health care providers and the public.

The Michigan work-related asthma surveillance team carried out new initiatives this past year on cleaning agents and welding fumes, two of the most common causes of work-related asthma in Michigan. The cleaning agent initiative is nearly completed using the data from the four states currently conducting surveillance for work-related asthma: California, Massachusetts, Michigan and New Jersey. Based on an examination of the characteristics and trends associated with cleaning agent exposures, we have developed a draft educational brochure on preventing cleaning agent exposures that can lead to work-related asthma. It is currently under review and will soon be distributed.

The second initiative involves the development and implementation of a Local Emphasis Program (LEP) for welding fumes. This program has been identifying workplaces with welding fume exposures during MIOSHA enforcement inspections. Collection of information during these inspections is being carried out and will allow us to better understand the factors most associated with the development of breathing problems and work-related asthma from welding fume exposures. Both of these initiatives will further our goal toward reducing the burden of occupational diseases in Michigan.

A third initiative that the Michigan surveillance team is working on in collaboration with California, Massachusetts and New Jersey involves analysis of health care worker exposures and asthma. By combing the data across four state surveillance systems we will be able to better describe and understand the breathing hazards of this segment of the work force.

The report of a patient with known or suspected work-related asthma is a sentinel health event that is critical to effective occupational disease surveillance. Case reporting from physicians offers the opportunity for the most timely workplace interventions, compared to receiving reports from hospitals. With continued support and increasing awareness of work-related asthma by physicians and other health professionals, we can continue to provide timely intervention in the workplace, offer suggestions for reducing workplace exposures even if they are below current permissible exposure levels, document the need for the development of new standards, identify new occupational allergens and prevent co-workers from developing disease.

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Figure 1. Number of Confirmed Cases of Work-Related Asthma by Year and Type

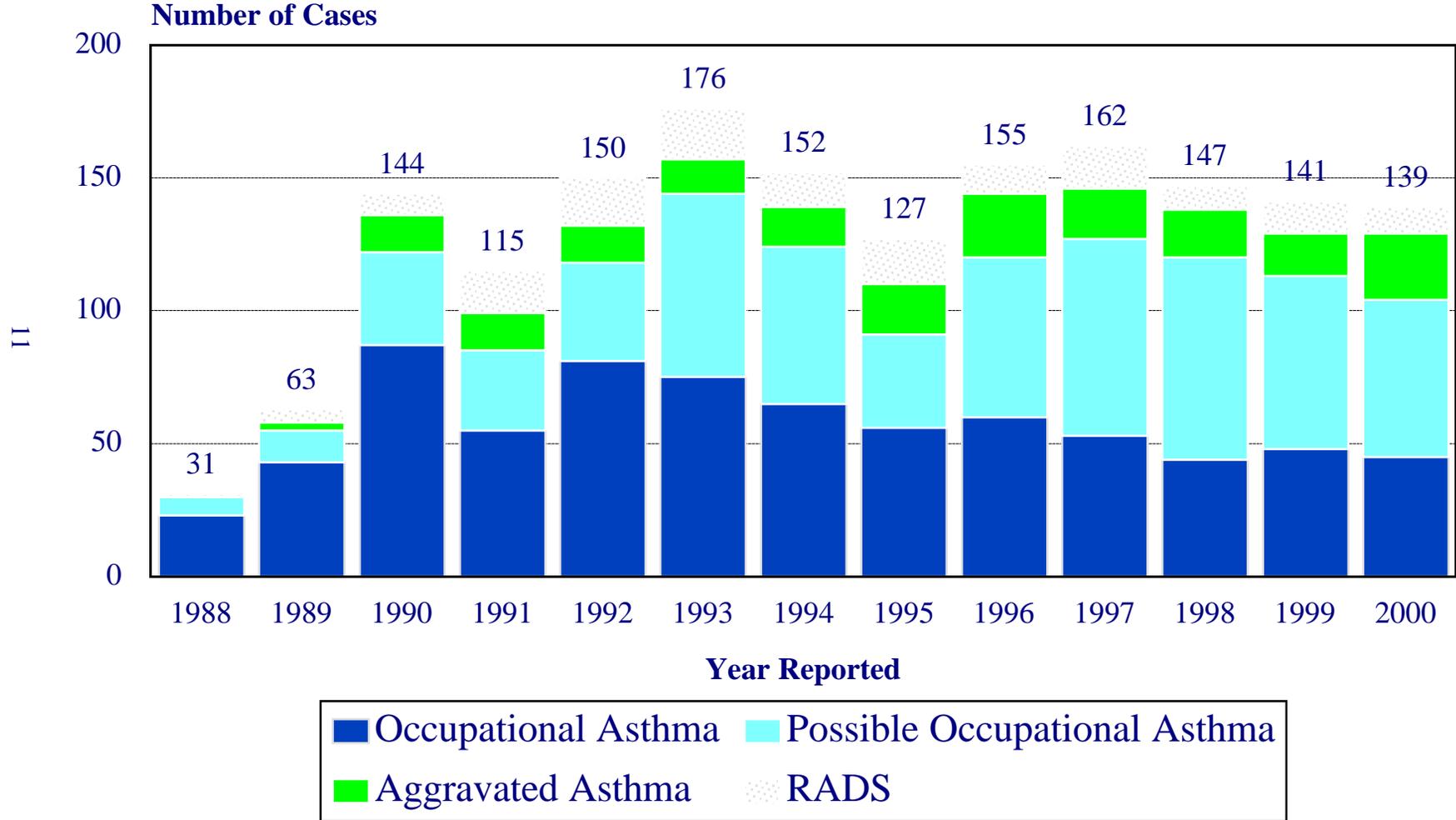
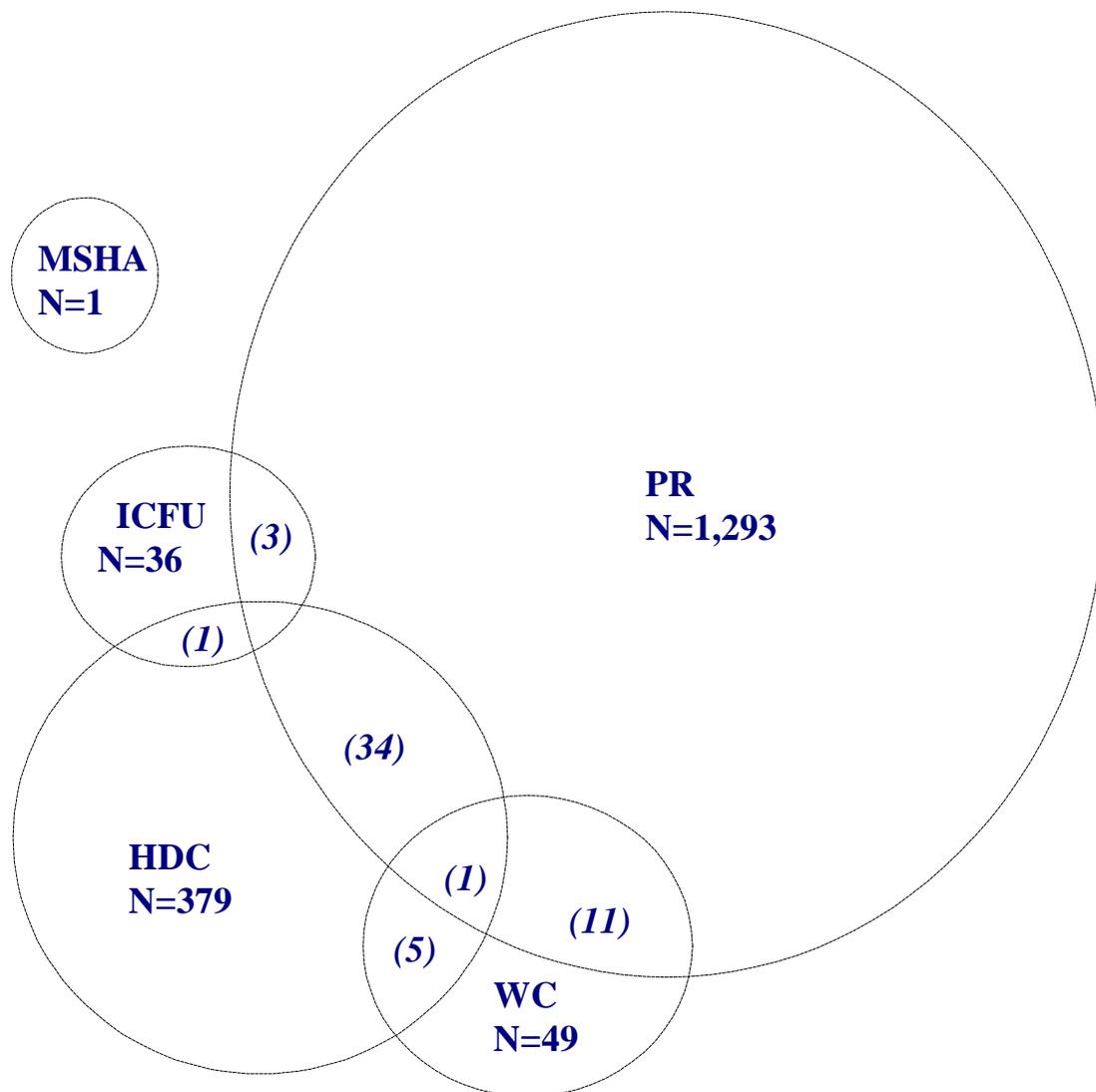
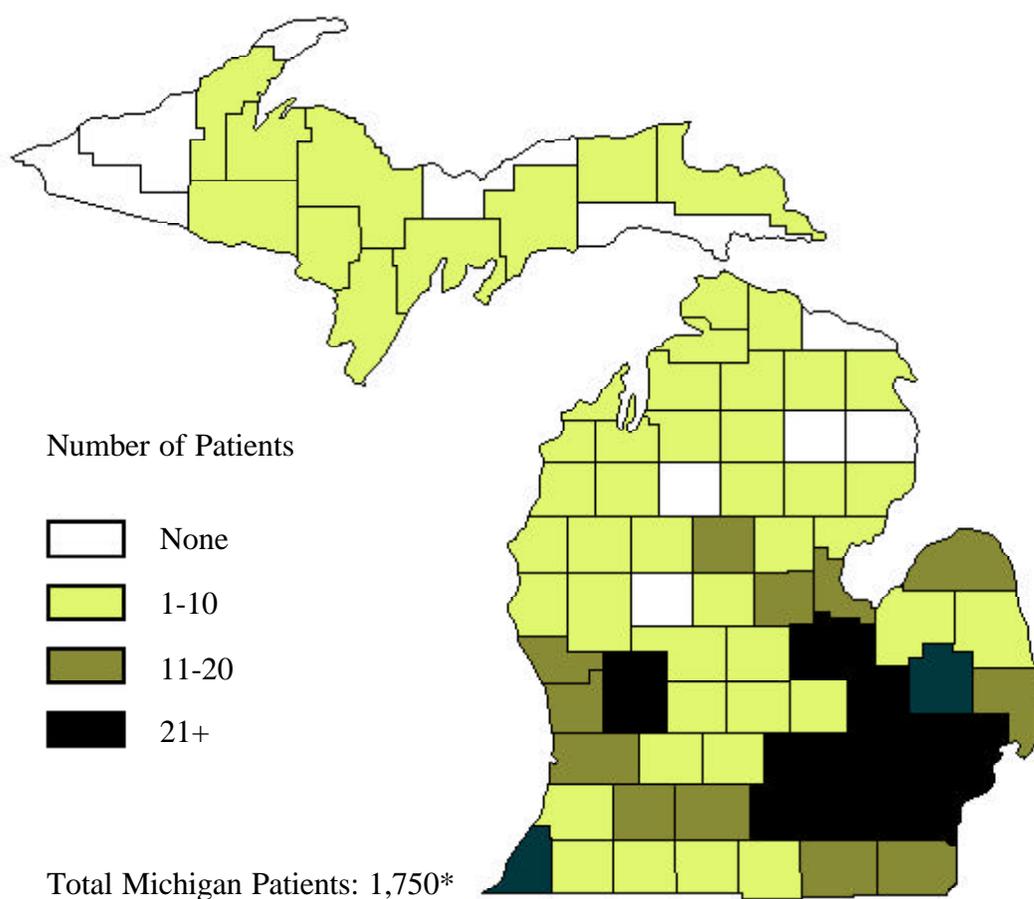


Figure 2. Overlap of Reporting Sources for Confirmed Work-Related Asthma Patients: 1988-2000*



* Diagram represents 1,702 individuals initially reported from 1988-2000. N's represent the total number for that source. Numbers in parentheses represent the overlap of reporting sources. Reporting Source Codes: HDC=Hospital Discharge Data; PR=Physician Referral; WC=Workers' Compensation; ICFU=Index Case Follow-Up; MSHA=Mine Safety and Health Administration.

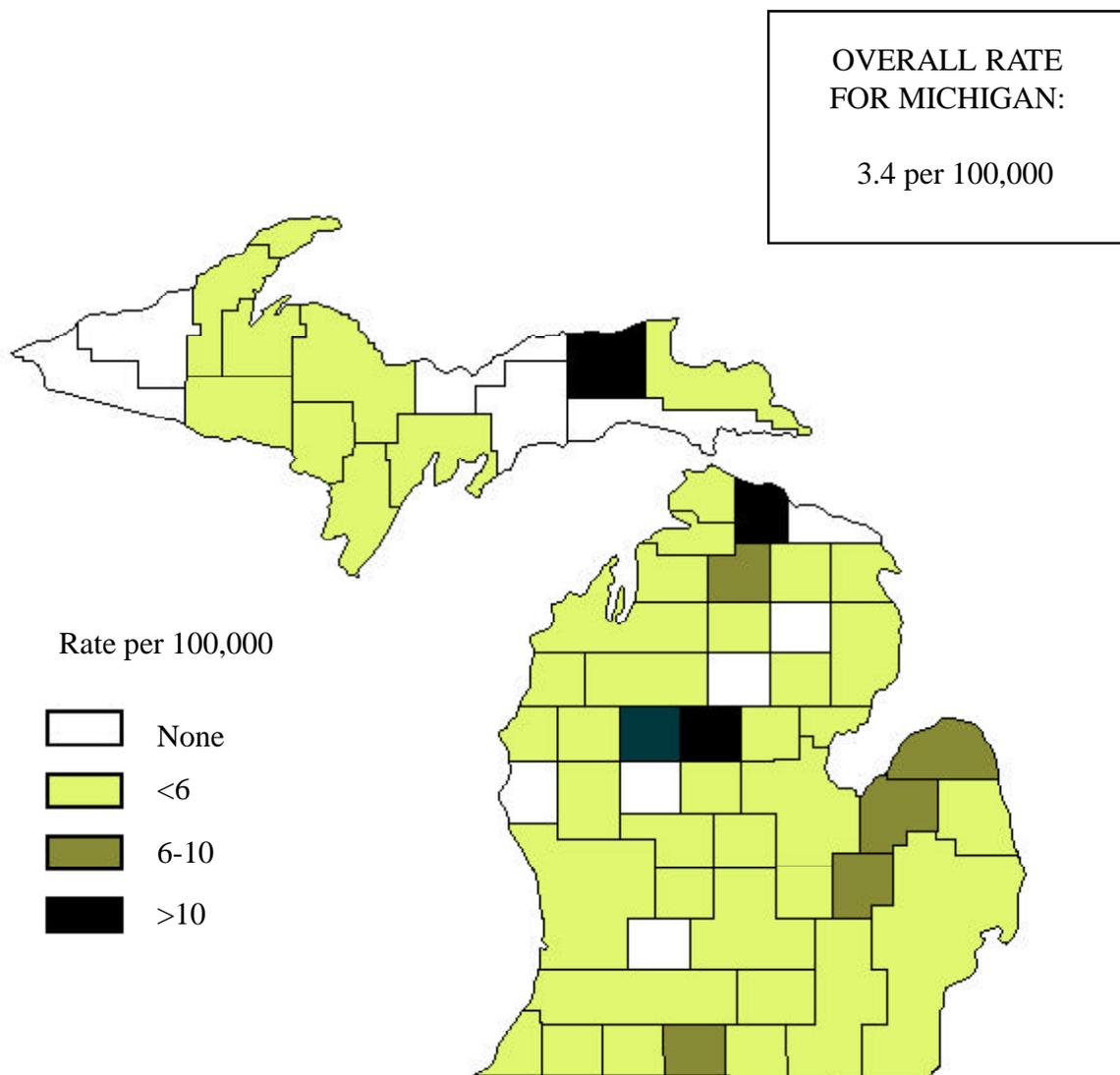
Figure 3. Distribution of Confirmed Work-Related Asthma Patients by County of Exposure: 1988-2001



Oakland and **Wayne** counties had the highest number of work-related asthma patients, with 237 and 460 individuals, respectively.

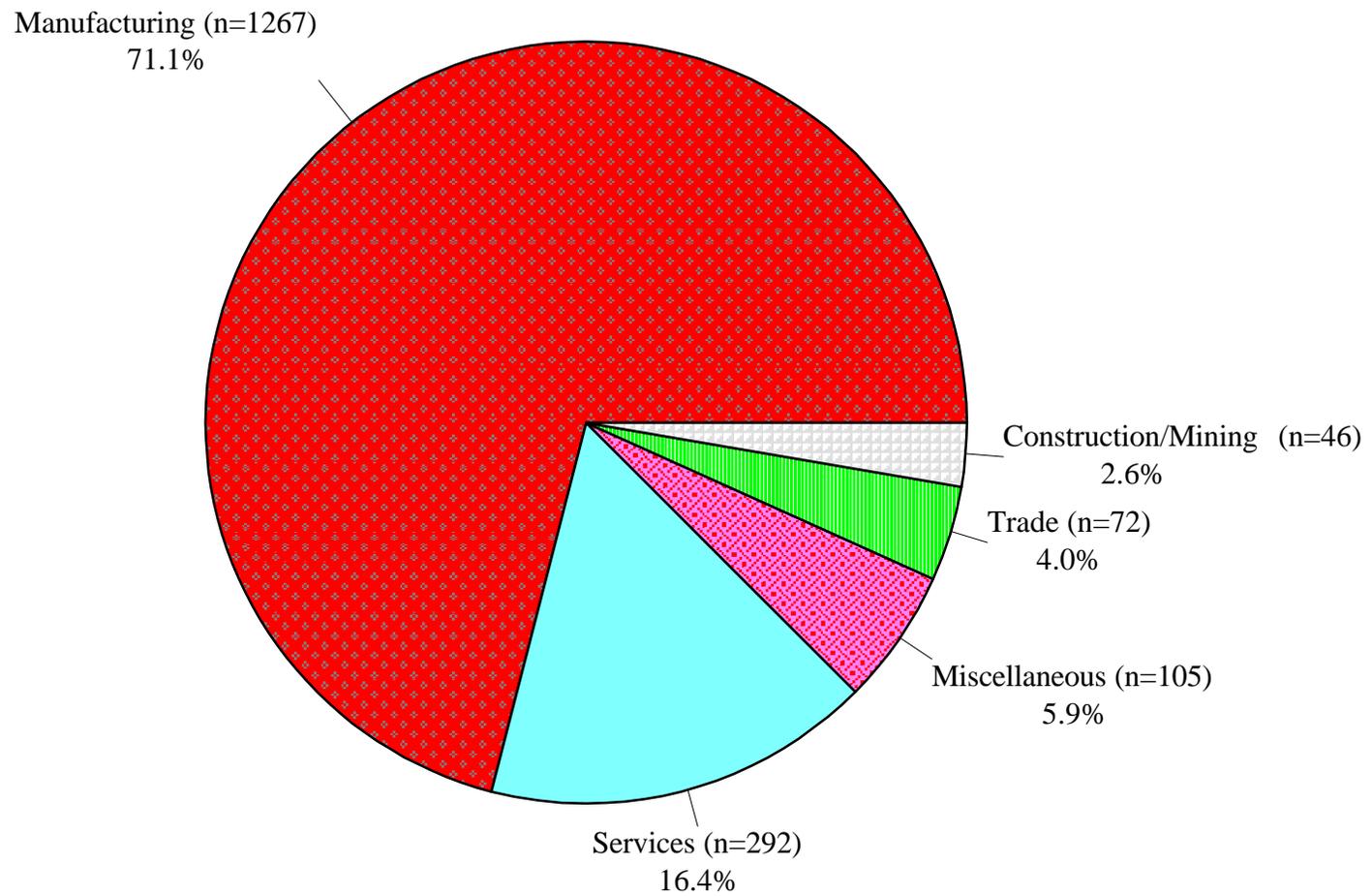
*County of exposure was unknown for 10 patients. Twenty-two patients were exposed out-of-state to an allergen.

Figure 4. Average Annual Incidence Rates of Work-Related Asthma Among Michigan Workers by County of Exposure: 1989-1999*



*Rate per 100,000 among Michigan workers. Source: MESC 1994 Annual Average Labor Statistics for Employment by Place of Work. In 1994, there were a total of 4,099,000 Michigan workers.

Figure 5. Major Industry Type for Confirmed Work-Related Asthma Patients: 1988-2001*



*Number of patients in parentheses, percent below.

Table 1. Number of Confirmed Cases of Work-Related Asthma by Year and Type

<u>YEAR</u>	<u>Disease Status*</u>					<u>TOTAL</u>
	<u>OA</u>	<u>POA</u>	<u>AA</u>	<u>RA</u>		
1988	23	7	0	1	31	
1989	43	12	3	5	63	
1990	87	35	14	8	144	
1991	55	30	14	16	115	
1992	81	37	14	18	150	
1993	75	69	13	19	176	
1994	65	59	15	13	152	
1995	56	35	19	17	127	
1996	60	60	24	11	155	
1997	53	74	19	16	162	
1998	44	76	18	9	147	
1999	48	65	16	12	141	
2000	45	59	25	10	139	
2001	35	32	9	4	80	
Total	770	650	203	159	1782	

*OA = occupational asthma; POA = possible occupational asthma; AA = aggravated asthma; RA = reactive airway dysfunction syndrome.

**Table 2. Average Annual Incidence Rates of Work-Related Asthma
Among Michigan Workers by County of Exposure: 1989-1999**

<u>County</u>	<u>Number of Employees</u>	<u>Avg. Annual Inc. Rate**</u>	<u>Total # Cases 1989-1999</u>
Alcona and Iosco (0, 2 cases respectively)	10,050	1.8	2
Alpena	12,200	2.2	3
Antrim	5,000	3.6	2
Arenac	4,300	4.2	2
Baraga	3,275	2.8	1
Berrien	68,800	2.4	18
Branch	12,600	6.5	9
Cass	10,375	2.6	3
Charlevoix	9,450	3.8	4
Cheboygan	7,025	10.4	8
Chippewa	14,650	1.9	3
Clare	7,275	12.5	10
Clinton-Eaton-Ingham (4, 9, 44 cases respectively)	217,000	2.4	57
Crawford	4,475	4.1	2
Delta	14,100	1.3	2
Dickinson	13,125	4.8	7
Emmet	14,000	1.3	2
Genesee	167,800	6.0	111
Gladwin	4,675	1.9	1
Grand Traverse-Benzie-Kalkaska-Leelanau (9, 2, 5, 2 cases respectively)	53,875	3.0	18
Gratiot	13,400	2.0	3
Hillsdale	14,475	5.0	8
Houghton-Keweenaw (1,0 cases respectively)	14,075	0.6	1
Huron	11,500	7.9	10
Ionia	15,025	5.4	9
Iron	3,825	2.4	1
Isabella	21,650	1.7	4
Jackson	56,800	4.2	26
Kalamazoo-Calhoun-VanBuren (13, 13, 4 cases respectively)	198,700	1.4	30
Kent-Ottawa-Muskegon-Allegan (38, 14, 16, 16 cases respectively)	479,600	1.6	84
Lake	1,725	5.3	1
Luce	2,150	21.1	5
Manistee	6,950	1.3	1
Marquette	28,750	2.2	7
Mason	10,375	0.9	1
Menominee	9,000	1.0	1
Montcalm	17,675	4.6	9
Montmorency	2,225	4.1	1
Newaygo	9,350	2.9	3
Ogemaw	5,725	1.6	1
Osceola	7,225	11.3	9
Otsego	9,200	8.9	9
Sanilac	11,825	4.6	6
Shiawassee	19,550	1.9	4
St. Joseph	23,275	2.0	5
Tuscola	13,500	6.1	9
Washtenaw-Lenawee-Livingston (95, 12, 21 cases respectively)	248,000	4.7	128
Wexford-Missaukee (3, 0 cases respectively)	16,150	1.7	3
Saginaw-Bay-Midland (42, 11, 9 cases respectively)	168,300	3.3	62
Detroit, MSA***	1,928,000	3.8	797
Out of State	---	---	19
Unknown	---	---	10
All Michigan Counties	4,099,000	3.4	1,532

*Source: MESO 1994 Annual Average Labor Statistics for Employment by Place of Work. Some employee population data is only available at a multi-county level, as indicated (i.e., not available at a single county level). Therefore, some data is presented with grouped counties. ** Rates are based on the average number of cases per year from 1989-1999, per 100,000 Michigan workers. *** MSA=Metropolitan Statistical Area and includes Lapeer (19 cases), Macomb (146 cases), Monroe (12 cases), Oakland (207 cases), St. Clair (12 cases) and Wayne (401 cases) counties.

Table 3. Annual Incidence Rates of Work-Related Asthma Among Michigan Workers by Major Metropolitan Area: 1990-1999

	<u>Clinton-Eaton-Ingham</u>	<u>Kent-Ottawa-Muskegon-Allegan</u>	<u>Saginaw-Bay-Midland</u>	<u>Detroit MSA**</u>	<u>Total (all Michigan)</u>
1990	1.4 (3)	2.2 (8)	2.4 (4)	3.0 (58)	3.6 (144)
1991	3.8 (8)	1.4 (5)	4.3 (7)	2.7 (50)	3.0 (115)
1992	5.6 (12)	0.7 (3)	1.8 (3)	4.6 (86)	3.8 (150)
1993	3.7 (8)	1.3 (6)	1.8 (4)	6.4 (121)	4.4 (176)
1994	1.8 (4)	3.5 (7)	1.8 (3)	4.4 (85)	3.7 (153)
1995	2.2 (5)	1.2 (6)	1.7 (3)	3.4 (69)	3.0 (127)
1996	1.3 (3)	0.9 (5)	2.9 (5)	4.0 (91)	3.5 (154)
1997	2.2 (5)	1.1 (6)	4.5 (8)	3.7 (77)	3.6 (162)
1998	2.6 (6)	1.4 (8)	3.9 (7)	3.7 (79)	3.3 (147)
1999	0.9 (2)	1.7 (10)	5.5 (10)	2.7 (59)	3.1 (141)

*Rate per 100,000 Michigan workers. Rate, number of cases in parentheses.

Source: MESC Annual Average Labor Statistics for Employment by Place of Work, for each year 1990-1999 separately.

**MSA=Metropolitan Statistical Area. For the years 1990-1995, includes Lapeer, Livingston, Macomb, Monroe, Oakland, St. Clair, and Wayne counties. For 1996, 1997, 1998, and 1999 does not include Livingston county because of a change in the counties associated with certain MSA's (including Detroit), beginning in 1996.

Table 4. Primary Industrial Exposure for Confirmed Work-Related Asthma Patients: 1988-2001

<u>Industry (SIC Code)*</u>	<u>Number of Cases</u> <u>1988-2001**</u>		<u>Number of</u> <u>Employees***</u>		<u>Ann. Average</u> <u>Inc. Rate****</u> <u>1989-1999</u>
MANUFACTURING (20-39)					
Automobile (37)	775	(43.5)	284,000	20.7	(648)
Ind. & Comm. Mach. & Computer Equipment (35)	72	(4.0)	121,000	4.5	(60)
Fabricated Metal Products (34)	74	(4.2)	122,000	5.1	(69)
Rubber and Misc. Plastic Products (30)	68	(3.8)	62,000	9.1	(62)
Foundries (33)	58	(3.3)	37,000	12.5	(51)
Food and Kindred Products (20)	34	(1.9)	43,000	6.3	(30)
Printing and Publishing (27)	17	(1.0)	44,000	2.9	(14)
Paper and Allied Products (26)	15	(0.8)	21,000	5.6	(13)
Lumber and Wood (24)	16	(0.9)	16,000	8.5	(15)
Electrical Equipment (36)	13	(0.7)	31,000	3.8	(13)
Furniture and Fixtures (25)	8	(0.4)	36,000	1.8	(7)
Apparel Made from Fabric (23)	2	(0.1)	19,000	1.0	(2)
Other Durables (32,38,39)	46	(2.6)	43,000	7.8	(37)
Other Nondurables (22,28,29,31)	69	(3.9)	51,000	11.2	(63)
WHOLESALE AND RETAIL TRADE (50-59)					
Wholesale-Nondurable Goods (51)	13	(0.7)	74,000	1.2	(10)
Food Stores (54)	11	(0.6)	103,000	1.0	(11)
Eating and Drinking Places (58)	10	(0.6)	270,000	0.3	(8)
Wholesale-Durable Goods (50)	13	(0.7)	125,000	0.9	(12)
Automotive Dealers and Gasoline Services (55)	9	(0.5)	78,000	0.8	(7)
General Merchandise Stores (53)	7	(0.4)	123,000	0.4	(5)
Miscellaneous Retail (52, 56, 57,59)	9	(0.5)	186,000	0.3	(7)
SERVICES					
Health (80)	156	(8.8)	338,000	3.7	(136)
Education (82)	53	(3.0)	371,000	1.1	(46)
Automotive Repair (75)	11	(0.6)	35,000	2.6	(10)
Business (73)	14	(0.8)	222,000	0.5	(13)
Social Services (83)	9	(0.5)	77,000	1.1	(9)
Engineering, Accounting, etc. (87)	8	(0.4)	85,000	0.6	(6)
Other Services (70,72,76,79,81,86,89)	41	(2.3)	263,000	1.3	(37)
CONSTRUCTION AND MINING (10-17)					
Special Trade Construction (17)	34	(1.9)	94,000	2.8	(29)
Other Construction (15-16)	8	(0.4)	46,000	1.6	(8)
Mining (10-14)	4	(0.2)	9,000	4.0	(4)
MISCELLANEOUS INDUSTRIES					
Government (91-97)	53	(3.0)	639,000	0.7	(47)
Transportation and Utilities (40-49)	29	(1.6)	159,000	1.5	(26)
Finance, Insurance and Real Estate (60-67)	11	(0.6)	195,000	0.4	(8)
Agricultural Production and Services (01,02,07)*****	8	(0.4)	36,683	1.2	(5)
Unknown	4	(0.2)	—	—	(4)
TOTAL	1782	(99.8)	4,099,000	3.4	(1532)

*Standard Industrial Classification.

**Number of cases, percentages are in parentheses.

***Source: MESC 1994 civilian labor force and industrial employment estimates.

****Average annual incidence rate, total number of cases for 1989-1999 are in parentheses. Rates are based on average number of cases from 1989-1999 per 100,000 adult workers in each industrial category.

*****Source: Michigan Department of Career Development, Statewide Average Monthly Industry Employment, 1994.

**Table 5. Primary Industrial Exposure for Confirmed
Work-Related Asthma Patients: 1990-1999**

INDUSTRY (SIC code*)	1990**	1991	1992	1993	1994	1995	1996	1997	1998	1999
Manufacturing (20-39)										
Food & Kindred Products (20)	20.0 (9)	6.7 (3)	2.3 (1)	-- (0)	2.3 (1)	4.4 (2)	6.8 (3)	4.9 (2)	7.5 (3)	2.6 (1)
Chemicals & Allied Product & Petroleum Refining (28,29)	17.0 (8)	4.3 (2)	14.0 (7)	12.0 (6)	7.8 (4)	14.3 (7)	*** (3)	*** (7)	*** (5)	10.2 (5)
Rubber & Misc. Plastic Products (30)	9.3 (5)	19.6 (10)	-- (0)	7.3 (4)	11.3 (7)	15.1 (10)	10.4 (7)	13.2 (9)	4.5 (3)	5.8 (4)
Foundries (33)	9.5 (4)	23.7 (9)	8.1 (3)	19.4 (7)	18.9 (7)	5.4 (2)	18.9 (7)	8.1 (3)	10.5 (4)	7.9 (3)
Fabricated Metal Products (34)	6.6 (8)	4.4 (5)	2.6 (3)	3.4 (4)	5.7 (7)	3.1 (4)	12.5 (16)	8.6 (11)	4.7 (6)	1.6 (2)
Industrial & Commercial Machinery & Computer Equipment (35)	6.3 (8)	1.7 (2)	6.1 (7)	8.5 (10)	6.6 (8)	3.0 (4)	3.0 (4)	2.2 (3)	3.7 (5)	2.3 (3)
Automobile (37)	19.0 (56)	15.6 (44)	28.7 (82)	26.5 (74)	25.0 (71)	17.3 (51)	21.1 (59)	21.1(61)	23.7 (65)	23.9 (65)
Other Durables (38,39)	19.2 (5)	8.0 (2)	4.9 (2)	9.8 (4)	-- (0)	-- (0)	6.7 (3)	4.4 (2)	6.5 (3)	8.9 (4)
Miscellaneous Industries										
Special Trade Construction (17)	1.1 (1)	2.3 (2)	4.6 (4)	6.7 (6)	3.2 (3)	0.9 (1)	1.7 (2)	0.8 (1)	2.4 (3)	2.3 (3)
Transportation & Utilities (40-49)	0.6 (1)	1.3 (2)	1.9 (3)	4.5 (7)	2.5 (4)	1.2 (2)	-- (0)	0.6 (1)	0.6 (1)	1.7 (3)
Health (80)	1.6 (5)	1.9 (6)	3.4 (11)	3.6 (12)	3.8 (13)	3.7 (13)	3.3 (12)	6.3 (23)	6.0 (22)	4.6 (17)
Education (82)	0.6 (2)	0.6 (2)	0.8 (3)	2.2 (8)	0.8 (3)	1.1 (4)	2.1 (8)	2.3 (9)	1.3 (5)	0.3 (1)
Government (91-97)	8.1 (5)	6.6 (4)	7.9 (5)	14.3 (9)	6.3 (4)	1.1 (7)	0.8 (5)	0.5 (3)	0.5 (3)	0.2 (1)
Total (all industries)	3.4 (144)	2.8 (114)	3.5 (150)	4.0 (176)	3.4 (152)	3.0 (127)	3.3 (152)	3.2 (161)	3.0 (147)	3.4 (141)

*Standard Industrial Classification.

**Annual Incidence rate; number of cases for that year are in parentheses. Rates are based on the number of cases per 100,000 adult workers in Michigan for each year separately.

Source: MESC Annual Average civilian labor force and industrial employment estimates.

***Denominator not available in 1996, 1997, 1998 and 1999.

Table 6. Occupational Agents Associated with 1782 Confirmed Work-Related Asthma Patients: 1988-2001

<u>Allergen</u>	<u>Number</u>	<u>Percent</u>
Isocyanates	304	17.1
Metal-Working Fluids	216	12.1
Unknown (Mfg.)	129	7.2
Unknown (Office)	111	6.2
Cleaning Solutions	104	5.8
Exhaust, Smoke, Fumes	101	5.7
Welding Fumes	90	5.1
Solvents	54	3.0
Latex/Rubber	51	2.9
Formaldehyde	42	2.4
Epoxy	42	2.4
Paint Fumes	41	2.3
Acrylates	34	1.9
Acids	30	1.7
Chlorine	26	1.5
Cobalt	25	1.4
Styrene	20	1.1
Wood Dust	19	1.1
Plastic Fumes	16	0.9
Flour	15	0.8
Ammonia	12	0.7
Herbicide, Pesticide	12	0.7
Chromium	11	0.6
Printing Inks	11	0.6
Amines	9	0.5
Grain Dust	9	0.5
Caustics	8	0.4
Animals	8	0.4
Fiberglass	8	0.4
Meat Wrappers' Asthma	7	0.4
Pickling Ingredients	6	0.3
Cement Dust	5	0.3
1,1,1 Trichloroethane	5	0.3
Glutaraldehyde	5	0.3
Rose Hips	4	0.2
Sulfonate	4	0.2
Sulfur Dioxide	4	0.2
Cosmetology Chemicals	4	0.2
Nitrogen	4	0.2
Colophony	3	0.2
Photo Developing Fluids	3	0.2
Phthalic Anhydride	3	0.2
Cadmium Solder	2	0.1
Enzymes	2	0.1
Nickel	2	0.1
Other *	161	9.0
Total	1782	99.9*

*Includes: x-ray developing fluids, chemicals used in the construction industry, freon, sulfite, gas and oil refinery exposures, maleic anhydride, solder fumes, vinyl acetate, ozone, zinc, textile lint, 1,3, dichloro-2-propanol, pepper gas, exercise, weeds, soda ash, asbestos, limone, coal dust, ethylene oxide, trichloroethylene, iodine, polyvinyl butyrate, lime dust, polyester, MEK, nylon-polyhexamethylene adipamide, potassium aluminum fluoride, ammonium hydroxide, methanol, naphtha, drywall dust, paper dust, zinc oxide, methylene chloride, ethylene glycol monobutyl ether, sewage, tar fumes, monoammonium phosphate, potassium hydroxide, ethyl alcohol, heptane, stress, sodium hydroxide, platinum, phosgene, cyanide, heat, polyethylene, perchloroethylene, hydraulic oil, blood, 1,3 dichloro 5 5-dimethyl hydrantoin, ninhydrin, cigarette smoke, azodicarbamide, lactase, medications, sodium acetate, cellulose, glaze, sulfuric acid, aspirin, tetrahydrofuran, zinc borate, leather, rust inhibitor, citrus spray, mold release, sand, hydrogen sulfide, teflon, flux, natural gas, tuberculosis vaccine, fungus, gortex, hydrogen peroxide, sludge, premicide, chlorpyrifos, psyllium, lavender soap, perfume, copper oxide, and asphalt.

**Percentages do not add to 100 due to rounding.

**Table 7. Cigarette Smoking Status of Confirmed
Work-Related Asthma Patients: 1988-2001**

<u>Smoking Status</u>	Disease Status				
	<u>ALL</u> *	<u>OA</u> **	<u>POA</u>	<u>AA</u>	<u>RA</u>
Current Smoker	348 (20.1)	168 (22.3)	104 (16.5)	38 (19.8)	38 (24.8)
Ex-Smoker	696 (40.2)	296 (39.2)	272 (43.1)	62 (32.3)	66 (43.1)
Non-Smoker	687 (39.7)	291 (38.5)	255 (40.4)	92 (47.9)	49 (32.0)
Total	1731	755	631	192	153

*Total number of cases: 1731. Smoking status was missing on 51 individuals. Number of patients, percentages are in parentheses.

**OA=occupational asthma; POA=possible occupational asthma; AA=aggravated asthma; RA=reactive airway dysfunction syndrome.

Table 8. Family History of Allergies Among Confirmed Work-Related Asthma Patients: 1988-2001

Family History of Allergies	Disease Status				
	<u>ALL</u>*	<u>OA</u>**	<u>POA</u>	<u>AA</u>	<u>RA</u>
YES	663 (42.0)	278 (39.5)	236 (40.8)	94 (58.4)	55 (40.1)
NO	916 (58.0)	425 (60.5)	342 (59.2)	67 (41.6)	82 (59.9)
Total	1579	703	578	161	137

*Total number of cases: 1579. Missing data on 203 patients. Number of patients, percentages are in parentheses.

**OA=occupational asthma; POA=possible occupational asthma; AA=aggravated asthma; RA=reactive airway dysfunction syndrome.

**Table 9. Personal History of Allergies or Asthma
Among Confirmed Work-Related Asthma
Patients: 1988-2001**

<u>Personal History</u>	Disease Status				
	<u>ALL*</u>	<u>OA**</u>	<u>POA</u>	<u>AA</u>	<u>RA</u>
YES	804 (45.1)	299 (38.8)	268 (41.2)	183 (90.1)	54 (34.0)
NO	978 (54.9)	471 (61.2)	382 (58.8)	20 (9.9)	105 (66.0)
Total	1782	770	650	203	159

*Number of patients, percentages are in parentheses.

**OA=occupational asthma; POA=possible occupational asthma; AA=aggravated asthma;
RA=reactive airway dysfunction syndrome.

Table 10. Persistence of Symptoms and Medication Use in Confirmed Work-Related Asthma Patients: 1988-2001

<u>Exposure Status</u>	<u>Total*</u>	<u>Symptoms</u>		<u>Asthma Medications</u>	
		<u>Yes</u>	<u>Less</u>	<u>Yes</u>	<u>Less</u>
Still Exposed	516	490 (95.0)	168 (32.6)	439 (85.1)	107 (20.7)
No Longer Exposed	1130	950 (84.1)	569 (50.4)	867 (76.7)	336 (29.7)
Total	1646	1440	737	1306	443

*Total number of cases: 1646. Information missing on 136 individuals. Number of patients, percentages are in parentheses.

**Table 11. Status of Facilities Where 1782 Patients with
Confirmed Work-Related Asthma were
Exposed to Allergens: 1988-2001**

<u>Inspection Status</u>	<u>Number of Patients Represented</u>	<u>Number</u>	<u>Percent</u>
Inspections	905	537*	42.7
No Follow-up Planned	735	590	46.9
Scheduled for Inspection	13	11	0.9
Closed	37	35	2.8
No Longer Use Occupational Allergen	22	21**	1.7
Sent Company an Indoor Air Letter	23	19	1.5
Sent Company a Letter to Check Exposures	47	46	3.7
Total	1782	1259***	100.2****

*537 inspections were conducted in 475 different facilities.

**Five companies that no longer use the allergen were previously inspected.

***Represents 1,197 different facilities.

****Percent does not add to 100 due to rounding.

Table 12. Results of 537 Industrial Hygiene Inspections in 475 Facilities Where Patients with Confirmed Work-Related Asthma were Exposed to Allergens: 1988-2001

<u>Inspection Results</u>	<u>Number</u>	<u>Percent</u>
Air Sampling - NIOSH Standard		
Above NIOSH Standard	54	10.1
Below NIOSH Standard	320	59.6
No NIOSH Standard	10	1.9
Unknown (no report yet)	3	0.6
Did Not Sample for an Allergen	10	1.9
<u>Did Not Sample</u>	<u>140</u>	<u>26.1</u>
Total	537	100.2*
Air Sampling - MIOSHA Standard		
Above MIOSHA Standard	24	4.5
Below MIOSHA Standard	359	66.9
No MIOSHA Standard	2	0.4
Unknown (no report yet)	3	0.6
Did Not Sample for an Allergen	9	1.7
<u>Did Not Sample</u>	<u>140</u>	<u>26.1</u>
Total	537	100.2*

*Percent does not add to 100 due to rounding.

**Table 13. Symptoms Consistent with Work-Related Asthma
Among Fellow Workers of the 1782 Confirmed
Work-Related Asthma Patients**

<u>Symptoms*</u>	Disease Status of Index Patient				
	<u>ALL**</u>	<u>OA</u>	<u>POA</u>	<u>AA</u>	<u>RA</u>
Daily or Weekly SOB, Wheezing or Chest Tightness	1315 (17.2)	1000 (17.9)	280 (15.4)	4 (16.0)	31 (13.5)
<u>OSHA Log***</u>	504 (18.4)	380 (22.1)	113 (12.2)	2 (12.5)	9 (11.1)
Total	1819****	1380****	393	6	40

*Denominator for calculating percentages was the number of workers interviewed. SOB=shortness of breath.

**Number of individuals with symptoms, percentages are in parentheses. OA=occupational asthma; POA=possible occupational asthma; AA=aggravated asthma; RA=reactive airways dysfunction syndrome.

***Numerator for calculating percentages was the number of companies with an employee other than the index patient on the OSHA log. Denominator for calculating percentages was the number of companies inspected.

****Eight individuals were identified both on the questionnaire and the OSHA log.

Table 14. Prevalence of Lifetime and Current, Childhood and Adult Onset Asthma by Gender

2001 Michigan BRFSS*

	<u>Total</u>	<u>Males</u>	<u>Females</u>
Lifetime asthma	12.4 ±1.2**	10.5 ±1.8	14.1 ±1.6
Lifetime asthma, child onset	5.7 ±0.9	6.5 ±1.5	4.9 ±1.1
Lifetime asthma, adult onset (≥16y)	6.2 ±0.8	3.5 ±1.0	8.7 ±1.3
Current asthma	8.8 ±1.0	6.7 ±1.5	10.8 ±1.5
Current asthma, child onset	3.5 ±0.7	3.7 ±1.2	3.4 ±0.9
Current asthma, adult onset (≥16y)	5.0 ±0.7	2.9 ±0.9	7.0 ±1.2

*Behavioral Risk Factor Surveillance System.

**Percentages with 95% confidence interval limits.

Table 15. Proportion of Individuals Whose Asthma May be Work-Related, by Gender

2001 Michigan BRFSS*

	<u>Doctor</u>	<u>Respondent</u>	<u>Either</u>
Lifetime asthma	4.9 ±1.8**	5.8 ±2.2	8.1 ±2.5
Lifetime asthma, child onset	2.4 ±1.9	2.5 ±2.1	3.6 ±2.4
Lifetime asthma, adult onset (≥16y)	7.3 ±3.1	9.2 ±4.0	12.5 ±4.4
Current asthma	5.8 ±2.3	7.0 ±2.9	9.7 ±3.2
Current asthma, child onset	3.4 ±2.9	4.0 ±3.3	5.3 ±3.7
Current asthma, adult onset (≥16y)	7.3 ±3.3	9.3 ±4.6	12.7 ±4.9
Males			
Lifetime asthma	5.4 ±3.2	7.7 ±4.4	9.8 ±4.8
Current asthma	6.1 ±4.0	10.4 ±6.4	12.6 ±6.8
Child onset	3.6	4.9	5.7
Adult onset (≥16y)	7.7	18.0	20.1
Females			
Lifetime asthma	4.7 ±2.2	4.6 ±2.3	7.1 ±2.7
Current asthma	5.6 ±2.8	5.1 ±2.8	8.1 ±3.3
Child onset	3.3	3.2	4.9
Adult onset (≥16y)	7.1	6.0	9.9

*Behavioral Risk Factor Surveillance System.

**Percentages with 95% confidence interval limits.