August 14th, 2013

2011 Annual report

Tracking Silicosis & Other work-related Lung Diseases in michigan

2011 ANNUAL REPORT TRACKING SILICOSIS & OTHER WORK-RELATED LUNG DISEASES IN MICHIGAN

Silicosis & Other Work-Related Lung Disease Surveillance Program

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There are many resources available to help employers, employees, health care professionals and others understand more about work-related lung disease. Links to these resources can be found at: **www.oem.msu.edu**.

Acronyms

AB Asbestosis

COPD Chronic Obstructive Pulmonary Disease

LARA MI Department of Licensing & Regulatory Affairs

MIOSHA Michigan Occupational Safety & Health Administration

NAICS North American Industrial Classification System

NIOSH National Institute for Occupational Safety & Health

OLDS Other Work-Related Occupational Lung Diseases

PEL Permissible Exposure Limit

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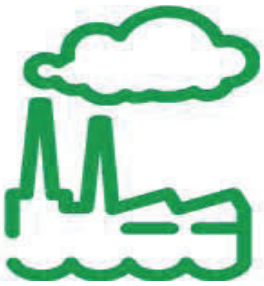
We sincerely appreciate the commitment of those health care providers who understand the public health significance of diagnosing a patient with an occupational illness, as well as the Michigan employees who took the time to share their experiences about their work and subsequent development of work-related lung disease.

Summary

This is the 20th annual report on silicosis in Michigan. This year marks the expansion of the annual report to include initial surveillance data on the magnitude and nature of other work-related lung diseases in Michigan. In 2011 we expanded surveillance of silicosis in Michigan to include other lung disease, including asbestosis, work-related hypersensitivity pneumonitis, hard metal lung disease, the minor pneumoconioses and emerging lung diseases. Work-related asthma has always been covered under a separate annual report.



The annual average incidence rate of silicosis among African American males is 8.4 cases per 100,000 workers. Among white males the rate is 1.5 cases per 100,000 workers. Within specific counties in Michigan, the annual average incidence rates of silicosis range between two to 583 times higher for African American males than the rates for white males.

Part 56 of the Michigan Public Health Code requires reporting of all known or suspected occupational illnesses or work-aggravated health conditions to the Michigan Department of Licensing & Regulatory Affairs *within 10 days of discovery*.

Summary, continued...

- On average, 27 new cases of silicosis are reported to LARA each year.
- From 1985-2011, 1,119 silicosis cases have been identified through the Michigan tracking system.
- We estimate there are 67-139 adults in Michigan with silicosis who were not reported in 2011.
- 139 cases of Other Work-Related Lung Disease (OLDS) were identified in 2011.
- Chemical irritation/ irritative bronchitis was the most frequently reported OLDS, followed by symptoms from smoke inhalation, chemical pneumonitis, COPD and hypersensitivity pneumonitis.
- MIOSHA enforcement inspections at 4 of the workplaces where an OLDS case was reported revealed violations of a variety of standards including Hazard Communication, but companies were within Permissible Limits for exposures associated with their lung diseases.
- In 2009, there were 796 individuals where asbestosis was one of the discharge diagnoses.

Background

In 1988, the State of Michigan instituted a tracking program for silicosis with financial assistance from NIOSH. In 2011 surveillance was expanded to include Other Work-Related Lung Diseases (OLDS). This is a joint project of MIOSHA (LARA) and Michigan State University (MSU), Department of Medicine, Division of Occupational and Environmental Medicine.

The reporting of an index patient is a sentinel health event that may lead to the identification of employees from the same facilities who are also at risk of developing silicosis or OLDS. The goal is to prevent work-related lung disease through the identification and workplace follow-up of these index patients.

Work-Related Lung Disease Tracking Procedures...

Patients are identified through mandatory reporting of any known *or suspected* occupational illnesses, including silicosis and other work-related lung diseases.

SOURCES TO IDENTIFY PATIENTS

- **Health Care Providers** Private practice, working for industry, NIOSH-certified "B" readers
- **Hospitals** ICD-9 502, 501, 495, 496, 491, 492
- **Workers' Compensation Agency**
- **Poison Control Center**
- **Reports from Co-Workers or MIOSHA Field Staff** confirmed by a health care provider
- **Death Certificates**
- **Michigan 3rd Judicial Court** for asbestos-related disease
- **Mine Safety and Health Administration**
- **Michigan Cancer Registry** for mesothelioma

Work-Related Lung Disease Tracking Procedures in Michigan

IDENTIFY PATIENTS

- **Review Reports**
  -Submitted to LARA
- **Known or Suspected**
  -Work-Related Lung Disease
- **Letter to Patient**

INTERVIEW PATIENTS

- **Telephone Interview**
  -Medical & work history
- **Obtain Medical Records**
  -Breathing test results
  -Chest x-ray
- **Physician Review**
  -Board-certified in occupational medicine

WORKPLACE INSPECTION

- **Inspection Referral**
  -MIOSHA determines Inspection, if indicated
- **On-Site Inspection**
  -Assess exposures, conduct air monitoring
  -Injury & Illness Log
  -MSU reviews chest x-rays
  -MSU interviews workers
  -Evaluate medical program
- **Off-Site Inspection**
  -Company addresses issues
  -MSU interviews co-workers
  -Report to company and MIOSHA

FOLLOW UP ACTIVITIES

- **Inspection Results**
  -Company
  -Workers
  -Reporting Physician
- **Letters to Individual Co-Workers**
  -See doctor if breathing problems reported during interview
- **Analyze Data**
  -Annual Report
  -Other outreach & educational materials

INTERVIEW PATIENTS

A telephone interview with the suspected work-related lung disease patient is conducted, and medical records are obtained, including any pulmonary function test results or chest x-rays.

WORK-RELATED LUNG DISEASE

Physician who is board-certified in internal and occupational/environmental medicine and also is a NIOSH certified B-reader reviews medical evidence which may include interview, medical records, breathing tests and chest x-rays. In addition, for silicosis and asbestosis the following criteria are applied:

SILICOSIS

1) History of silica exposure.

And

2) Chest x-ray interpretation with rounded opacities of 1/0 or greater profusion in the upper lobes.

OR

1) A biopsy report of lung tissue showing the characteristic silicotic nodule.

ASBESTOSIS

1) History of asbestos exposure.

And

1) Chest x-ray interpretation showing linear changes in the lower lobes and/or pleural thickening.

Individuals with silicosis in Michigan have an increase of over 300% in the likelihood of dying from non-malignant respiratory disease, both restrictive and obstructive, and an 80% increase in the likelihood of dying from lung cancer. [1]

Workplace Inspections

After the patient interview is completed, a MIOSHA workplace enforcement inspection may be conducted.

During an inspection:

- Co-workers are interviewed to determine if other individuals are experiencing similar breathing problems from exposure to the agent.
- Chest x-rays are reviewed if the company performs periodic x-ray surveillance.
- Air monitoring for any suspected agent is conducted.
- The company's health and safety program is reviewed.

After the investigation is complete, a report of air sampling results and any recommendations is sent to the company and made available to workers. A copy of the report is also sent to the reporting physician.

OTHER FOLLOW UP ACTIVITIES

Outreach, educational activities, and recommendations may be developed. An annual report summarizing the activity is completed.

Results— SILICOSIS, ASBESTOS- & OTHER WORK-RELATED LUNG DISEASES

The following sections report results in this order: **silicosis** surveillance in Michigan from 1985-2011, **asbestos-related lung disease and mesothelioma**, and **all other OLDS surveillance** for calendar year 2011.

REPORTS OF SILICOSIS

Table 1 shows that 1,119 people were confirmed with silicosis between 1985—2011. Figure 1 shows the number of confirmed silicosis cases by year, for 1987—2011. Figure 2 shows the overlap of reporting sources.

TABLE 1
Year and Reporting Source for 1,119 Confirmed Silicosis Cases: 1985-2011

	Reporting Source*				
YEAR	PR	HDC	DC	WC	ICFU
85-88	0	123	41	49	0
89-90	12	84	9	10	4
91-92	21	91	7	8	0
93-94	13	67	2	32	0
95-96	54	70	3	2	0
97-98	23	76	2	0	0
99-00	9	57	1	1	0
01-02	9	43	2	0	0
03-04	10	50	0	0	0
05-06	5	43	1	0	0
07-08	6	37	0	2	0
2009	1	12	1	0	0
2010**	2	17	0	0	0
2011**	0	7	0	0	0
TOTAL	165	777	69	104	4

*PR– Physician Referral; HDC-Hospital Discharge ; DC-Death Certificate; WC-Workers' Compensation; ICFU-Index Case Follow-Up.

**Reports are still being processed for calendar years 2010 and 2011.

FIGURE 1
Confirmed Silicosis Cases by Year Reported

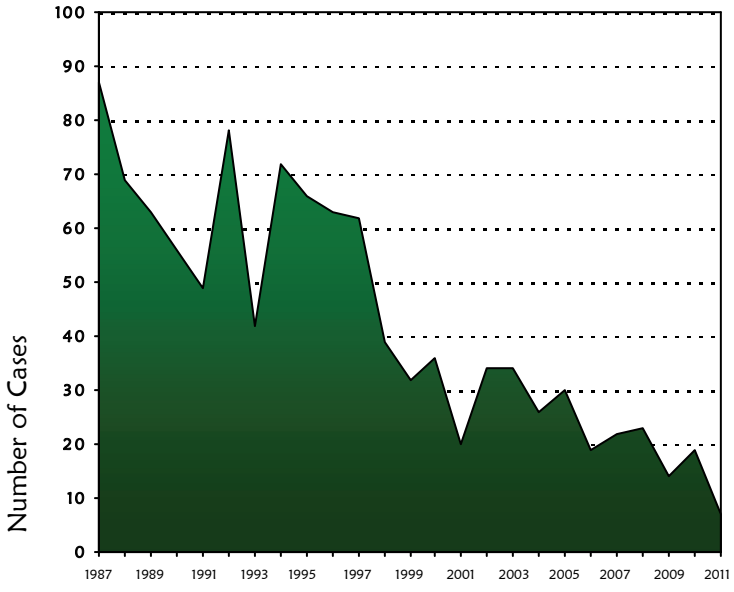
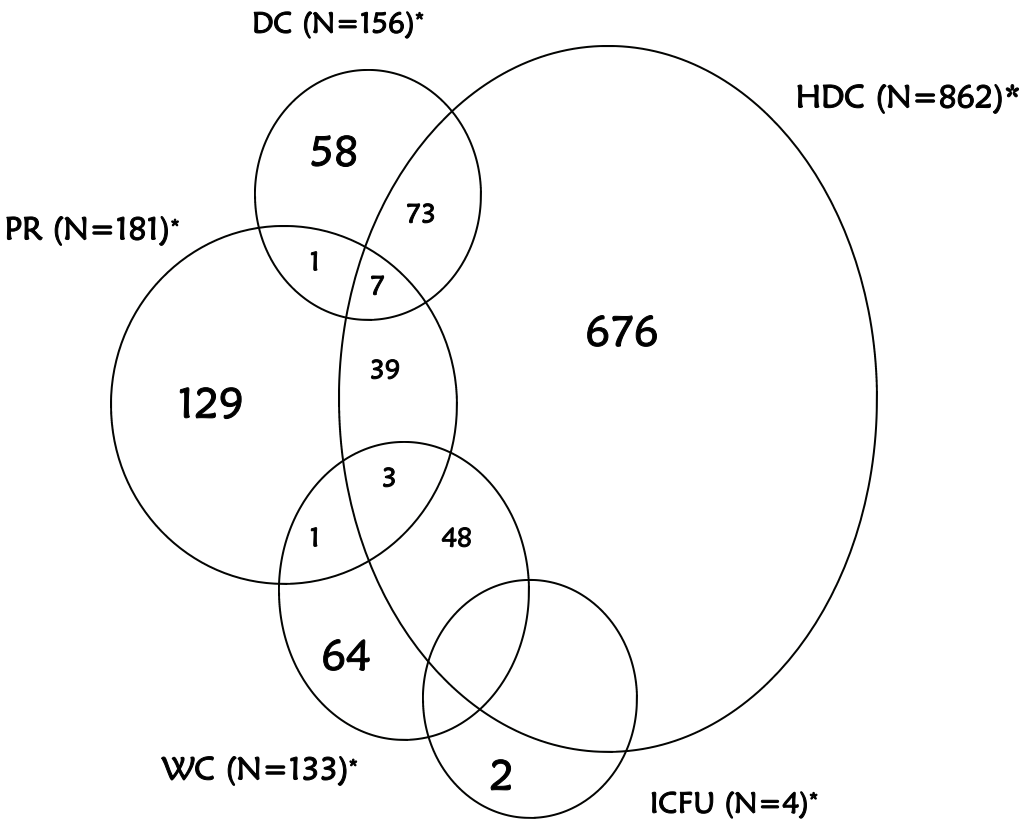


FIGURE 2
Overlap of Reporting Sources for 1,119 Confirmed Silicosis Patients: 1985-2011



*N's represent the total number for that source.
Reporting Source Codes: HDC=Hospital Discharge Data; PR=Physician Referral; DC=Death Certificate; WC=Workers' Compensation; ICFU=Index Case Follow Up.
There was also an overlap of HDC-DC-WC for 13 individuals; an overlap of HDC-PR-WC-DC for one individual; an overlap of HDC-WC-ICFU for one individual; an overlap of WC-DC for two individuals; and an overlap of HDC-DC-ICFU for one individual.

Hospitals are the most frequent reporters of workers with occupational lung diseases.

Based on capture-recapture analysis we estimate that although on average we receive 27 reports of silicosis a year, there are an additional 67-139 cases that are diagnosed each year but are not reported. [2]

Demographics-Silicosis

GENDER

- Women 25, 2%
- Men 1,094, 98%

YEAR OF BIRTH

- Range 1888—1971
- Average 1923

RACE

- Caucasian 637, 57%
- African American 443, 40%
- Alaskan/American Ind. 1, <1%
- Asian 2, <1%
- Other 28, 3%
- Unknown 8

ANNUAL INCIDENCE RATE

- African American 8.4
- Caucasian 1.5

The annual incidence rate for African Americans is almost 6X greater than that of Caucasians.

Numerator is the average number of silicosis cases by race for 1987-2009. Denominator Source: 2000 Census population data by race, age 40 and older.

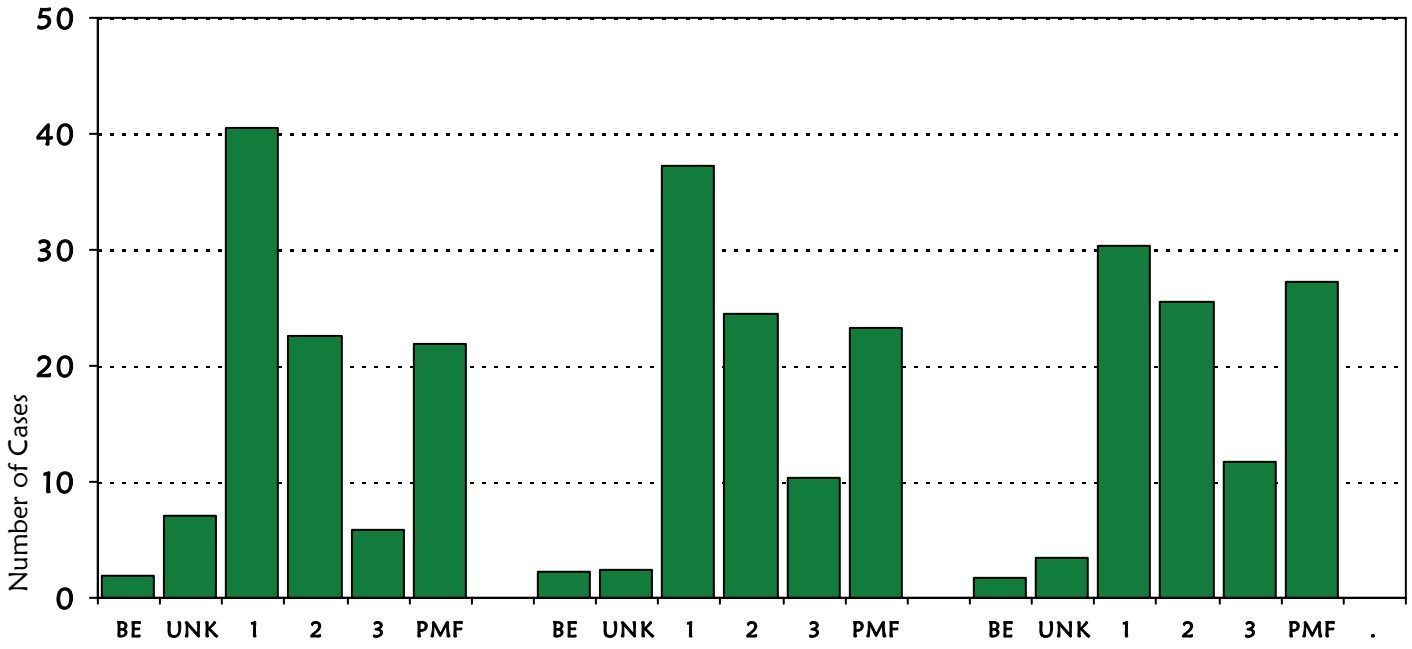
Medical Results-Silicosis

Overall 787 (70.3%) of the people with silicosis had simple silicosis and 270 (24.1%) had progressive massive fibrosis. Twenty-four (2.1%) silicotics had normal x-rays with lung biopsy evidence. Thirty-eight (3.4%) individuals had x-ray reports which were consistent with silicosis but the actual radiograph could not be obtained to classify.

For the 1,103 silicosis cases with known smoking history, 297 (26.9%) of the people with silicosis never smoked cigarettes, 651 (59.0%) had quit, and 155 (14.1%) were still smoking. No information was available on 16 individuals. Figure 3 shows the distribution of x-ray results according to the ILO classification and smoking status. Non-smokers tended to have more severe silicosis. This latter finding may be an artifact of our reporting system, which is mainly based on reports of hospitalized individuals. Non-smoking individuals with simple silicosis are less likely to be symptomatic and hospitalized and therefore less likely to have been reported to the surveillance system.

Tables 2 and 3 show the distribution of percent predicted forced vital capacity (FVC) and the ratio of forced expiratory volume in one second (FEV_1) to FVC by x-ray and cigarette smoking status. Approximately 64% of people with silicosis had reduced breathing function, either restrictive or obstructive. Obstructive changes (Table 3) were found in two thirds of the individuals who had ever smoked cigarettes and among half of the individuals who had never smoked cigarettes. A more comprehensive analysis of spirometry results was published in 2010. [3]

FIGURE 3
Severity of X-Ray Results* by Smoking Status for Confirmed Silicosis Cases: 1985–2011**



*BE = Biopsy Evidence; UNK = Unknown; 1-3 = International Labor Organization categorization system for grading pneumoconises; Category 1 = 1/0, 1/1, 1/2; Category 2 = 2/1, 2/2, 2/3; Category 3 = 3/2, 3/3, 3/+; PMF = Progressive Massive Fibrosis.

**Total number of individuals: 1,103. Unknown smoking status for 16 individuals.

Medical Results-Silicosis

TABLE 2

Percent Predicted Forced Vital Capacity (FVC) by X-Ray Results and Cigarette Smoking Status for Confirmed Silicosis Cases: 1985-2011

	Percent Predicted FVC***					
	<60%		60-79%		>=80%	
X-Ray Results*	Ever Smoked	Never Smoked	Ever Smoked	Never Smoked	Ever Smoked	Never Smoked
	%	%	%	%	%	%
Biopsy Evidence	8	--	50	67	42	33
Unk Severity	41	40	36	20	23	40
Category 1	24	31	36	29	41	40
Category 2	30	39	36	33	34	29
Category 3	26	67	43	14	31	19
PMF	38	38	33	32	29	30
Total**	29	39	36	30	35	32

*Biopsy Evidence if no x-ray available; International Labor Organization categorization system for grading pneumoconioses: Cat 1= 1/0, 1/1, 1/2; Cat 2= 2/1, 2/2, 2/3; Cat 3= 3/2, 3/3, 3+; PMF=Progressive Massive Fibrosis.
**Total number of individuals: 712. Information was missing for 407 individuals.
***Percentages represent the proportion of individuals in each x-ray result category, within smoking status category.

TABLE 3

Ratio of Forced Expiratory Volume in 1 Second (FEV_1) to Forced Vital Capacity (FVC) by X-Ray Results and Cigarette Smoking Status for Confirmed Silicosis Cases: 1985-2011

	FEV_1/FVC**							
	<=40%		41-59%		60-74%		>=75%	
X-Ray Results	Ever Smoked	Never Smoked	Ever Smoked	Never Smoked	Ever Smoked	Never Smoked	Ever Smoked	Never Smoked
	%	%	%	%	%	%	%	%
Biopsy Evidence	--	50	15	--	54	50	31	--
Unk Severity	11	--	11	--	22	80	56	20
Category 1	10	2	21	4	36	35	33	59
Category 2	4	4	21	14	40	29	34	53
Category 3	3	5	18	--	13	30	67	65
PMF	16	6	32	22	30	35	22	37
Total	9	4	23	11	34	34	34	50

*Biopsy Evidence if no x-ray available; International Labor Organization categorization system for grading pneumoconioses: Cat 1= 1/0, 1/1, 1/2; Cat 2= 2/1, 2/2, 2/3; Cat 3= 3/2, 3/3, 3+; PMF= Progressive Massive Fibrosis.
**Total number of individuals: 682. Information was missing for 437 individuals.
***Percentages represent the proportion of individuals in each x-ray result category, within smoking status category.

Location in State

Table 4 shows the annual average incidence rates of silicosis among the working population, by race and county where there was at least one case in that county. The highest rates were among black males in Shiawassee (350 cases per 100,000), Muskegon (152 cases per 100,000), Saginaw (51 cases per 100,000), and Monroe (27 cases per 100,000). The incidence of African American silicosis cases was approximately 6 times greater than Caucasian males. Figure 4 shows the counties of the companies at which the patients' silica exposure occurred; Muskegon, Wayne and Saginaw were the main counties.

TABLE 4
Average Annual Incidence Rate of Silicosis Among Michigan Workers by Race and County of Exposure: 1987-2009

	Caucasian* Males			African American** Males				Caucasian* Males			African American** Males		
County	County Pop'n	#	Rate	County Pop'n	#	Rate	County	County Pop'n	#	Rate	County Pop'n	#	Rate
Allegan	20850	2	0.4	275		—	Keweenaw	639	1	7.1	1		—
Alpena	7388	22	13.5	8		—	Lake	2817	2	3.2	251		—
Arenac	4168	1	1.1	62		—	Lapeer	18176	1	0.3	226		—
Baraga	1815	1	2.5	78		—	Lenawee	20192	4	0.9	573		—
Barry	12360	3	1.1	34		—	Livingston	32610	2	0.3	111		—
Bay	23674	7	1.3	226		—	**Macomb**	**156926**	**16**	**0.5**	**3233**	**7**	**9.8**
Benzie	3898	1	1.2	9		—	Manistee	5999	2	1.5	67		—
Berrien	**30479**	**6**	**0.9**	**3594**	**3**	**3.8**	Marquette	14199	13	4.2	224		—
Branch	9525	4	1.9	288		—	Mason	6683	1	0.7	41		—
Calhoun	**25345**	**24**	**4.3**	**2650**	**12**	**20.6**	Menominee	6054	10	7.5	2		—
Charlevoix	5942	3	2.3	5		—	Midland	16605	1	0.3	128		—
Chippewa	7286	1	0.6	616		—	**Monroe**	**29452**	**7**	**1.1**	**497**	**3**	**27.4**
Delta	9045	3	1.5	5		—	Montcalm	12433	3	1.1	335		—
Dickinson	6419	1	0.7	5		—	Montmorency	2957	1	1.5	3		—
Eaton	20377	3	0.7	781		—	**Muskegon**	**30132**	**104**	**15.7**	**3564**	**119**	**151.8**
Genesee	**69596**	**7**	**0.5**	**13423**	**4**	**1.4**	**Oakland**	**216359**	**12**	**0.3**	**20085**	**6**	**1.4**
Gladwin	6615	1	0.7	8		—	**Ottawa**	**41916**	**4**	**0.4**	**270**	**1**	**16.8**
Gogebic	4353	3	3.1	22		—	**Saginaw**	**36097**	**58**	**7.3**	**5936**	**67**	**51.3**
Gd Traverse	16451	1	0.3	57		—	**St. Clair**	**33209**	**5**	**0.7**	**623**	**1**	**7.3**
Gratiot	8356	1	0.5	371		—	**St. Joseph**	**12266**	**3**	**1.1**	**251**	**1**	**18.1**
Hillsdale	9857	7	3.2	36		—	Sanilac	9753	2	0.9	23		—
Ingham	41166	9	1.0	3987		—	Schoolcraft	2121	1	2.1	18		—
Iosco	7280	1	0.6	30		—	**Shiawassee**	**14737**	**2**	**0.6**	**26**	**2**	**349.7**
Iron	3531	1	1.3	28		—	Van Buren	15129	2	0.6	808		—
Jackson	**31380**	**3**	**0.4**	**2685**	**2**	**3.4**	Washtenaw	47535	6	0.6	5758		—
Kalamazoo	39985	3	0.3	3004		—	**Wayne**	**236472**	**114**	**2.2**	**134974**	**153**	**5.2**
Kent	**93136**	**13**	**0.6**	**6768**	**2**	**1.3**	Wexford	6478	2	1.4	6		—

*Rate per 100,000 among Caucasian men age 40+. Numerator is the average number of Caucasian males with silicosis for the years 1987 – 2009; denominator is the 2000 Census population data for Caucasian men age 40 and older, by county. In 2000, there were 1,730,017 Caucasian males 40 years and older living in Michigan.

** Rate per 100,000 among African American men age 40+. Numerator is the average number of African American males with silicosis for the years 1987 – 2009; denominator is the 2000 Census population data for African American men age 40 and older, by county. In 2000, there were 219,076 African American males 40 years and older living in Michigan.

Type of Industry-Silicosis

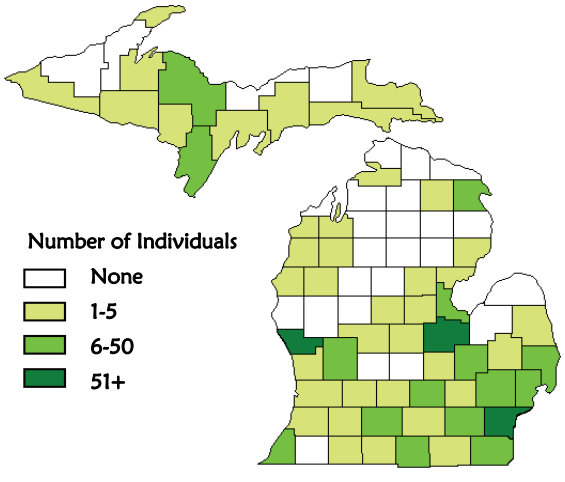
Table 5 shows the Michigan industries by NAICS codes, where exposure to silica occurred from 1985 to 2011. The predominant industries were in manufacturing (86%), construction (8%) and mining (4%). Most of the manufacturing jobs were in iron foundries. Exposure to silica is still occurring in foundries (Figures 5 and 6). In 2007, MIOSHA began an initiative to identify and inspect all silica-using foundries in the state. Forty-seven foundries were inspected. Personal air monitoring for silica was conducted in 43 of the 47 facilities; 28 companies had silica levels below the MIOSHA PEL and 15 were above the PEL.

Although silicosis typically occurs after a long duration of exposure to silica, some patients develop silicosis after a relatively short period of time because of the severity of that exposure. The average year of hire is 1949, ranging from 1910 to 2007. Two individuals began working in the 2000s, two began working in the 1990s, 17 in the 1980s, 72 in the 1970s and 163 in the 1960s. The average number of years worked at a silica-exposed job was 27.4 years.

TABLE 5
Primary Industrial Exposure for Confirmed Silicosis Patients: 1985-2011

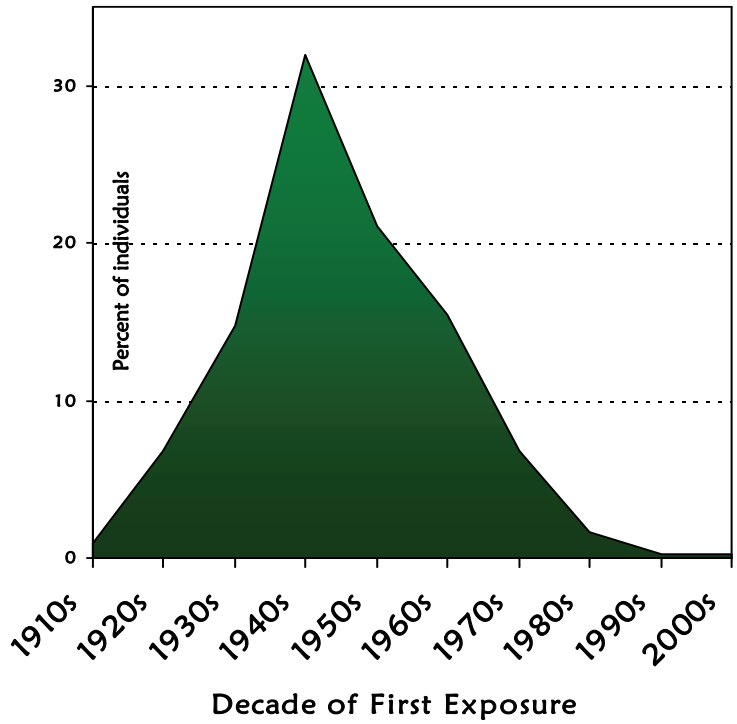
2002 North American Industry Classification System		#	%
11	Agriculture, Forestry, Fishing, & Hunting	2	0.2
21	Mining	39	3.5
22	Utilities	1	0.1
23	Construction	89	8.0
31-33	Manufacturing	959	85.7
42	Wholesale Trade	2	0.2
44-45	Retail Trade	2	0.2
48-49	Transportation & Warehousing	7	0.6
56	Administrative & Support & Waste Management	2	0.2
62, 81	Health Care & Social Assistance	7	0.6
92	Public Administration	4	0.4
00	Unknown	5	0.4
Total		1,119	

FIGURE 4
Distribution of Confirmed Silicosis Cases by County of Exposure: 1985-2011*



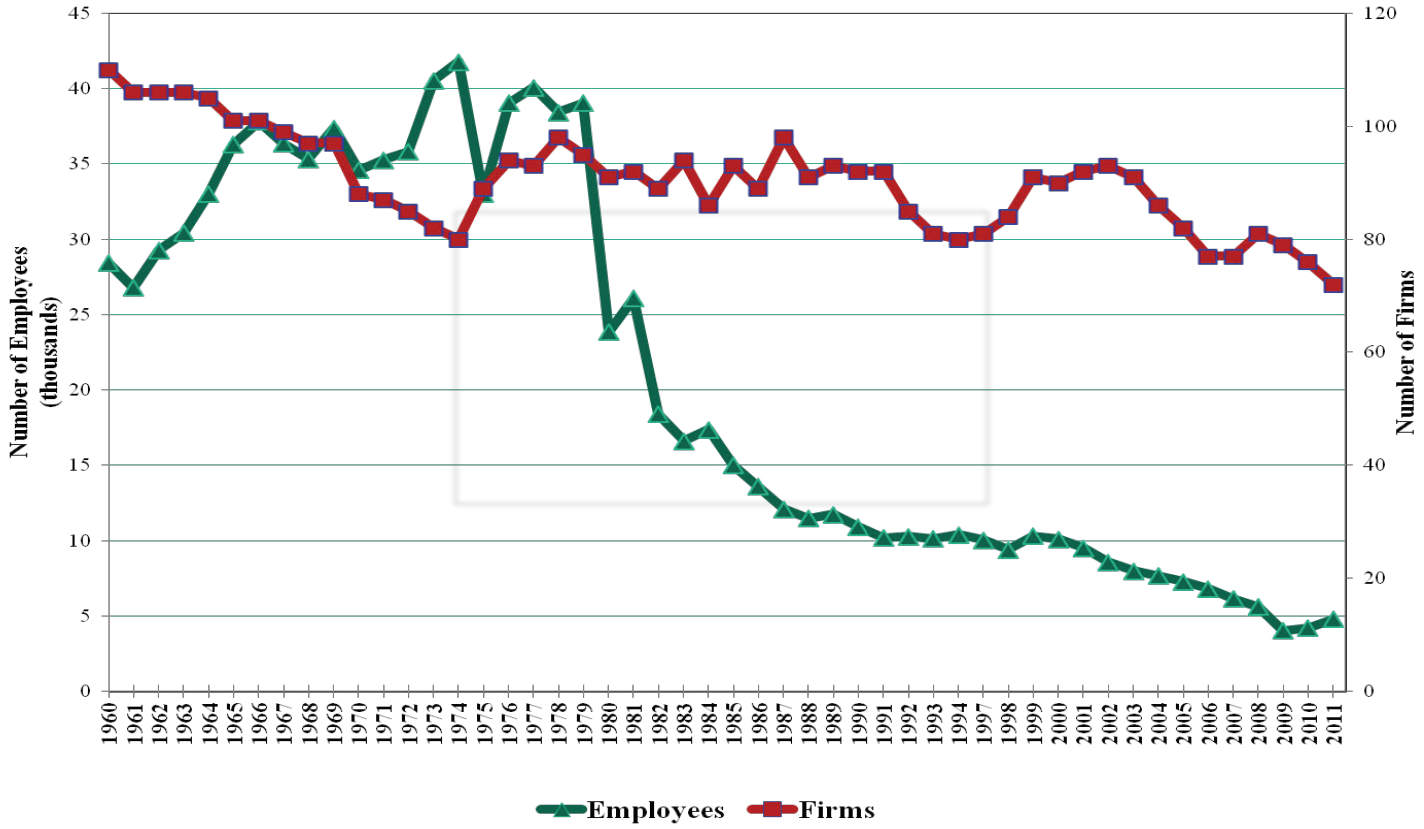
*Seventy-five individuals were exposed to silica out-of-state, and 23 individuals had an unknown county of exposure.

FIGURE 5
Distribution of Decade when Silica Exposure Began for Confirmed Silicosis Cases: 1985-2011*



*Decade of first exposure was unknown for 64 individuals with silicosis.

FIGURE 6
Michigan Ferrous Foundries 1960-2011



Industrial Hygiene Results-Silicosis

The 1,119 individuals with silicosis were exposed to silica in 451 facilities (Table 6). Inspections were performed by MIOSHA at 86 (19.1%) of these facilities. One hundred forty-eight (32.8%) facilities were no longer in operation, 66 (14.6%) were located out of state, 26 (5.8%) facilities no longer used silica, 61 (13.5%) workplaces were in the construction industry, two (0.4%) were inspected by the Mine Safety and Health Administration, and for 60 (13.3%) the specific location where the silica exposure occurred was unknown. There are two facilities scheduled for inspection.

Air sampling was conducted in 61 of the 86 facilities inspected (Table 7). Thirty-six of 61 (59.0%) facilities were above the National Institute for Occupational Safety and Health (NIOSH) recommended exposure limit for silica.

Twenty-two of the 61 (36.1%) were above the enforceable Michigan Occupational Safety and Health Administration (MIOSHA) permissible exposure limit for silica. Another two (3.3%) companies were above the MIOSHA standard for beryllium and one company was above the MIOSHA standard for silica and silver.

Only eight of the 69 (11.6%) facilities where the medical surveillance program was evaluated provided medical screening for silicosis for its workers that included a periodic chest x-ray interpreted by a "B" certified reader. Three (4.3%) companies provided periodic chest x-rays that were not interpreted by a "B" certified reader. Twenty (29.0%) only performed pre-employment testing, 26 (37.7%) provided no medical surveillance, and 18 (26.1%) performed annual or biennial pulmonary function testing without chest x-rays.

Industrial Hygiene Results-Silicosis

TABLE 6
Status of Facilities Where 1,119 Confirmed Silicosis Cases were Exposed to Silica: 1985-2011

	Cases	Facilities	
Inspection Status	#	#	%
Inspection Completed	480	86	19.1
Scheduled for Inspection	2	2	0.4
Inspected by MSHA*	4	2	0.4
Facility Out of Business	414	148	32.8
Facility Out of State	70	66	14.6
Facility No Longer Uses Silica	28	26	5.8
Building Trade: No Inspection	61	61	13.5
Unknown	60	60	13.3
Total	1,119	451**	99.9

*MSHA= Mine Safety and Health Administration.

**Four facilities are related to one silicosis case's work history.

TABLE 7
MIOSHA Inspections of 86 Facilities of Silicosis Cases Exposed to Silica: 1985-2011

	Companies	
	#	%
Air Sampling Performed	61	
Above NIOSH* Rec Std for Silica	36	59.0
Above MIOSHA Enforceable Std for Silica	22	36.1
Medical Surveillance Evaluated	69	
Periodic Chest X-Rays with a B Reader	8	11.6
Periodic Chest X-Rays without a B Reader	3	4.3
Pre-employment Testing Only	20	29.0
No Medical Surveillance	26	37.7
Periodic Pulmonary Function Testing	18	26.1

*NIOSH = National Institute for Occupational Safety and Health.

**MIOSHA = Michigan Occupational Safety and Health Administration.

Sandblasting-Silicosis

Two hundred ninety-eight of the 839 individuals for whom sandblasting history was known (35.5%) stated they had done sandblasting as part of their work.

Abrasive Blasting Survey

In July 2011, letters were sent to 404 companies in Michigan that potentially did abrasive blasting; 283 of these companies were from a previous survey conducted in 2005 and 121 companies had been newly identified through internet search engines and were considered likely to perform abrasive blasting. The letter asked these companies to complete a survey about their abrasive blasting activities even if they did not use silica. The survey asked whether abrasive blasting was done by their company, what media were used, and how many individuals were employed and performed these activities.

Of the 404 companies identified, 162 were excluded due to: undeliverable address (66), unlisted or disconnected telephone number (77), and being out of business (19).

Of the 192 of 242 companies that completed the survey, 122 performed abrasive blasting, while 70 indicated they did not perform blasting. Of the 122 companies that perform abrasive blasting, 49 used silica. One of the companies that used silica reported that they did not use silica; rather, they indicated the use of "other abrasives" and described it as "play sand." Table 8 shows the abrasive material that was being used. Using similar methodology, we have identified the number of companies using silica as an abrasive in 1995, 1999, and 2005. Figure 7 shows the number of companies using silica as an abrasive for these four surveys.

Abrasive Blasting Survey

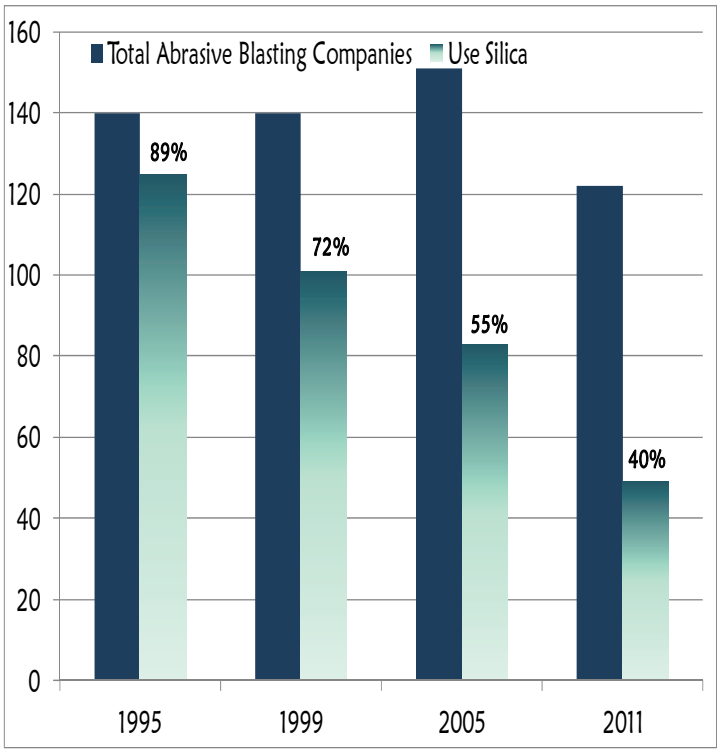
TABLE 8
Abrasive Blasting Media Used by 122 Companies that Reported Performing Abrasive Blasting: Michigan 2011

	Companies	
Media Type Used	#	%
Silica*	49	40.2
Steel Shot	45	36.9
Aluminum Oxide	29	23.8
Coal Slag	28	23.0
Glass Beads	28	23.0
Corn Cobs	19	15.6
Crushed Glass	12	9.8
Garnet	8	6.6
Iron Oxide	3	2.5
Other Media**	40	32.8

*24/49 companies indicated silica is the only media used. 1 of the companies that indicated use of other media and NO silica used, noted use of the following: Play Sand.

** Other media used included: Walnut Shells (15), Baking Soda (10), Plastic (9), Water (4), Silicon Carbide (3), Dry Ice (2), Synthetic Olivine (2), Melon Seed (1), Nickel Slag (1), DuPont Starblast (1), Imported from Canada (1), Mineral Fine (1), Black Slag (1), Ground Slag Shells (1), Ceramic (1).

FIGURE 7
Abrasive Blasting Survey of MI Companies, By Year of Survey and Use of Silica



Asbestos-Related Lung Disease and Mesothelioma

The following section reports the results of **asbestos-related lung disease and mesothelioma**.

Figure 8 shows the number of individuals hospitalized in Michigan with asbestosis and silicosis from 1990 to 2011. Repeat admissions of the same individual within each calendar year are excluded from these counts of Hospital Discharge Data (HDC). For most of these patients, pneumoconiosis was not the primary discharge diagnosis listed on the discharge record. From 1993 to 2009, there has been a steady increase in the number of hospitalizations for asbestosis (an almost 300% increase) (Figure 8). Regulations to control asbestos exposure were not promulgated until the early 1970s and were not widely implemented until the 1980s. Given the 25 year or greater latency period from the time of first exposure to the development of asbestos-related radiographic changes, the cases being identified now represent exposures from these earlier less-regulated years. The trend we are seeing in Michigan is consistent with national data published in the NIOSH Surveillance Report updates on asbestosis available at: http://www2a.cdc.gov/drds/WorldReportData/default.asp. [4]

Payment source from the Michigan Health and Hospital Association (MHA) is the source of data displayed in Figure 9. Medicare is the primary payment source for hospitalizations for these dust diseases of the lung. WC insurance is very rarely the source of payment, which is consistent with previous reports in both Michigan and New Jersey that the majority of patients with pneumoconiosis never apply for WC insurance. [1,5] It should be noted that if the anticipated payment source was initially workers' compensation but then changed to a non-work-related payment source, the record in the MHA file would still indicate the initial source after the patient was discharged, or vice-versa.

FIGURE 8
Number of Patients Discharged with Asbestosis & Silicosis in Michigan: 1990-2011

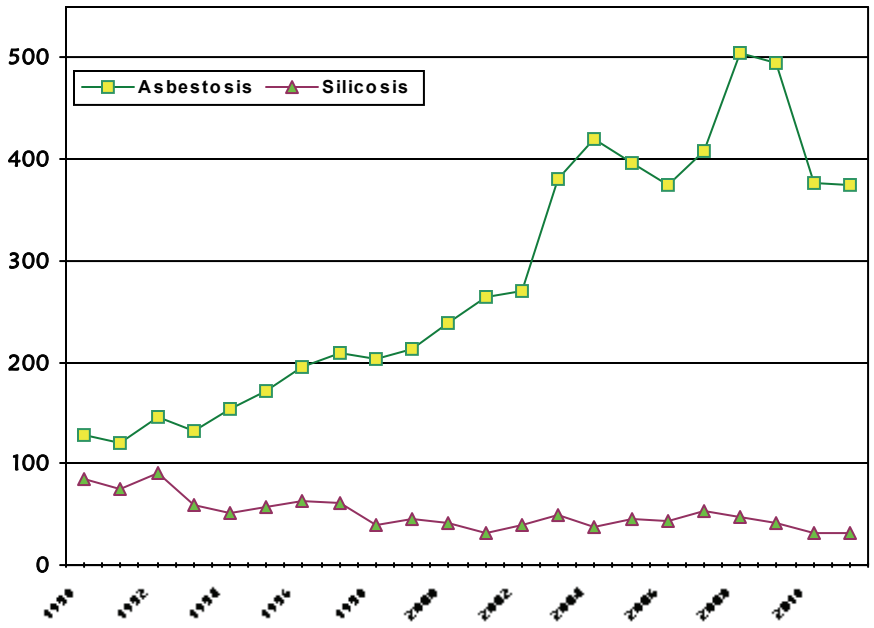
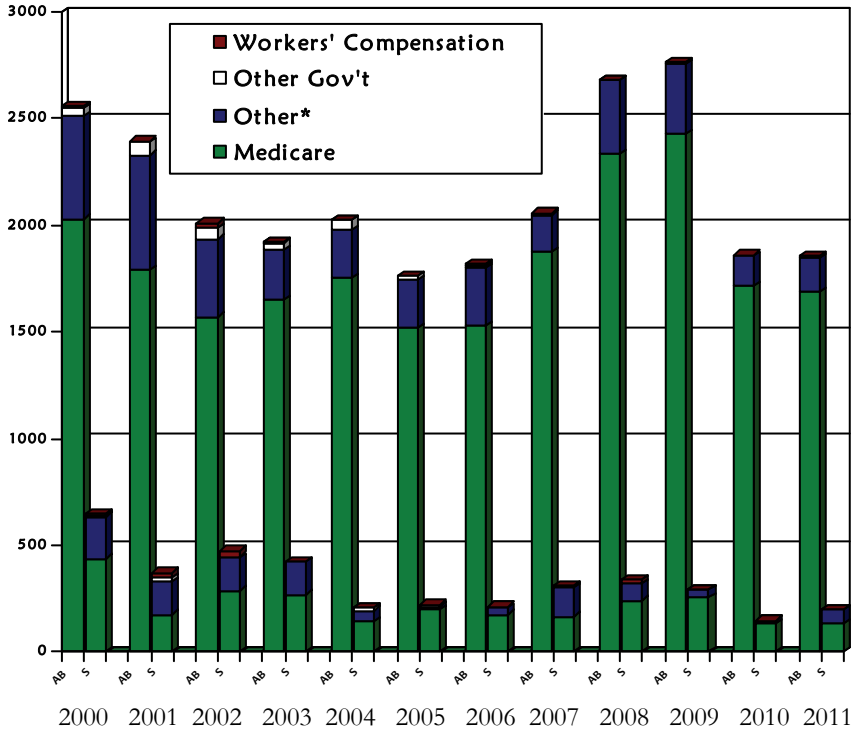


FIGURE 9
Days Hospitalized by Payment Source at Discharge for Asbestosis & Silicosis in Michigan: 2000-2011



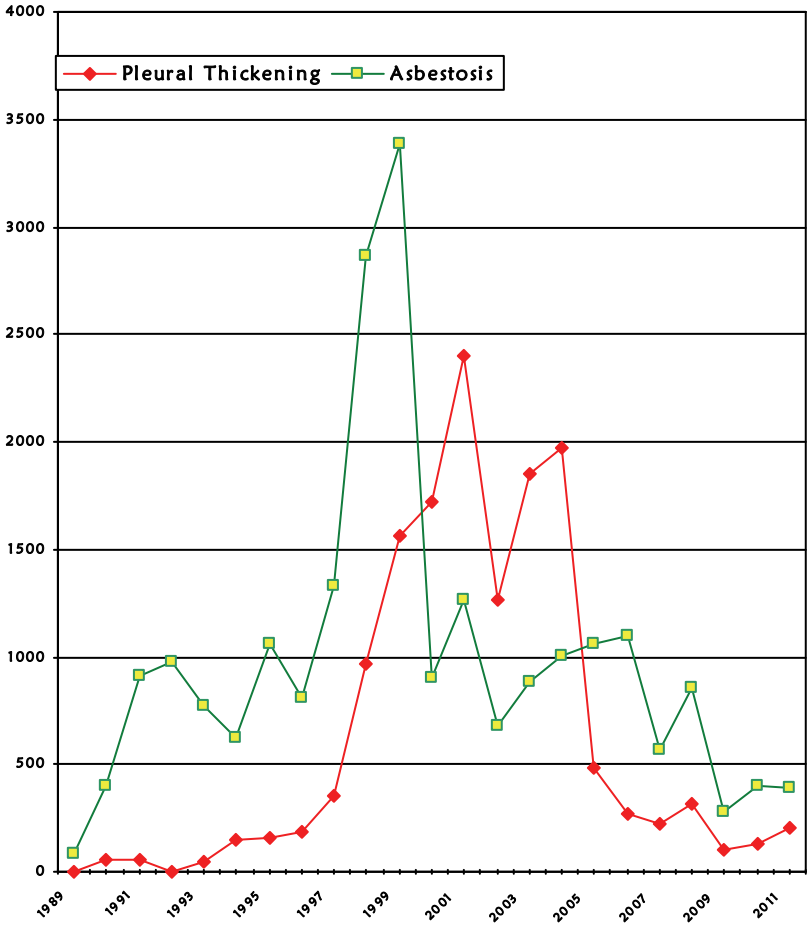
*Other includes: Medicaid, HMOs, PPOs, Other Insurance, Self-Pay and No-Charge payment sources.
AB--=Asbestosis, S=Silicosis.

Asbestos-related lung disease is the most common dust disease reported to the Michigan Department of Licensing and Regulatory Affairs (LARA). In addition to the Hospital Discharge Data (HDC) discussed in the previous section, individual physicians certified as B Readers and the Michigan Courts report cases of asbestosis to LARA. Some of these patients reported may overlap those reported in the HDC data. The total number of asbestos-related cases would therefore be less than the combined total of HDC cases along with the cases reported directly to LARA. The number of reports of asbestosis and pleural thickening from these sources since 1989 is shown in Figure 10.

B READER SURVEY

In 1995, there were 16 B-readers in Michigan. Today, there are only six physicians in Michigan who are certified as B-readers. Table 9 shows the number of B-readers, chest x-rays that were reviewed, and x-rays that showed evidence of asbestos-related lung disease, with pleural and parenchymal changes separately and combined. Since 1995, about 20% of the x-rays reviewed showed evidence of occupational disease, ranging from a low of 829 (8%) of 10,591 x-rays reviewed in calendar year 2000, 313 (8%) of 4,170 x-rays reviewed in 2009 and 229 of 2,862 x-rays reviewed in 2011, to a high of 3,640 (34%) of 10,575 x-rays reviewed in calendar year 1999. Table 9 is based on an annual survey that the B-readers in Michigan complete. The numbers of reports listed in the survey are greater than the number of occupational disease reports received from B-readers.

FIGURE 10 Asbestos-Related Cases Reported to the MI Department of Licensing & Regulatory Affairs: 1989-2011



EVALUATION OF HOSPITAL DISCHARGE DATA: ASBESTOS-RELATED HOSPITAL VISITS, 2009

All hospital discharges/emergency department visits for asbestos-related disease were evaluated in calendar year 2009 with an ICD-9 code of 501 (asbestosis). There were 1,011 medical encounters on 796 individuals. The hospitals reported 481 outpatient visits, 453 hospitalizations and 77 emergency department visits for the 796 individuals.

Asbestosis (ICD 9 code 501) was the primary diagnosis for 237 of the 640 (37.0%) individuals where diagnostic code information was available. Three hundred sixty nine (57.7%) individuals also had at least one other diagnostic code for other lung disease or cancer (254 had COPD, 85 had pneumonia, 18 had lung cancer, five had mesothelioma and 34 had other types of cancer, including three with gastrointestinal cancers). Among 237 individuals with the primary diagnosis of asbestosis, 111 (46.8%) had a diagnostic code for other lung disease or cancer.

Seven hundred fifty-seven (95.1%) were men. The average age was 74 $\pm$ 10.5 years. Among the 556 individuals where race was known; 92.6% were Caucasian. Workers'

TABLE 9
Summary of "B" Reading Interpretations of Chest X-Rays in Michigan: 1995-2011

YEAR	# "B" Readers	Pleural Changes Only	Parenchymal Changes- W/ & W/out Pleural Changes	Pleural or Parenchymal Changes	Total X-Rays Reviewed	% of Total w/ any Changes
1995	16	--	--	1,406	8,165	17
1996	16	--	--	837	4,825	17
1997	16	446	522	968	6,652	15
1998	16	--	--	3,111	--	--
1999	18	1,045	2,595	3,640	10,575	34
2000	16	532	297	829	10,591	8
2001	17	1,211	1,316	2,527	11,149	23
2002	16	683	905	1.588	7,189	22
2003	11	1,440	1,289	2,729	10,589	26
2004	--	--	--	--	--	--
2005	9	502	343	845	3,060	28
2006	10	391	127	518	5,382	10
2007	9	201	130	331	3,661	9
2008	10	337	320	657	4,757	14
2009	9	247	66	313	4,170	8
2010	6	202	45	247	2,804	9
2011	6	183	46	229	2,862	8

Compensation was the payer of the medical encounter for only 0.4%, none of which had a primary diagnosis of asbestosis. Medicare paid for 56.3%, private insurance 41.1% and Medicaid 2.2% of the medical encounters. Among the 443 individuals where smoking status was available; 312 (70.4%) had ever smoked and 65 (14.7%) still smoked cigarettes.

Information on radiographic changes from radiographic reports was available on 516 individuals. Three hundred sixteen (61.2%) had parenchymal changes (216 of these individuals also had pleural changes), 125 (24.2%) had pleural changes only and the other 75 had no radiographic changes.

Table 10 shows the industry where asbestos exposure occurred for the 143 individuals where this information was available. Construction (53 cases, 37.1%), manufacturing (40 cases, 28.0%) and public safety (20 cases, 14.0%) were the three most common industrial sectors. Pipefitter was the most common occupation with 22 of 135 cases with known occupation. Other occupations included asbestos factory worker, electrician, mine worker and steel mill worker.

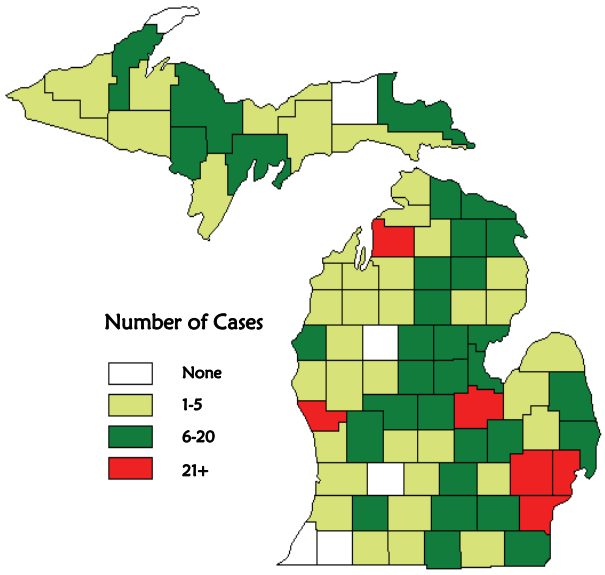
The counties with the greatest number of individuals with an asbestosis diagnosis were Wayne (164 cases, 21.3%), Oakland (49 cases, 6.4%), Saginaw (31cases, 4.0%), Macomb (30 cases, 3.9%), Muskegon (25 cases, 3.2%), Antrim (22 cases, 2.9%) and Marquette and Bay (each with 19 cases, 2.5%). Figure 11 is a map of the residence of all individuals with diagnosis of asbestosis, except for the 26 where county of residence was missing.

TABLE 10
Primary Industrial Sector of MI Residents Hospitalized with an Asbestos-Related Lung Disease, 2009

NIOSHA 10 National Occupational Research Agenda (NORA) Sectors, with 2002 NAICS code		#	%
11	Agriculture, Forestry, & Fishing	0	—
21	Mining	8	5.6
211	Oil & Gas	2	1.4
22,4 8-49	Transportation & Warehousing & Utilities	8	5.6
23	Construction	53	37.1
31-33	Manufacturing	40	28.0
42,4 4-45	Wholesale & Retail Trade	0	—
62	Health Care & Social Assistance	5	3.5
81	Services	7	4.9
922	Public Safety	20	14.0
Total*		143	

*There were 653 individuals for whom industry was unknown.

FIGURE 11
County of Residence of Michigan Patients Hospitalized with Asbestos-Related Lung Disease in 2009



Mesothelioma

The association between exposure to asbestos and the risk of developing mesothelioma was first reported in the medical literature in 1943. [6] The only other exposure associated with the risk of developing mesothelioma has been the therapeutic, not diagnostic, use of x-rays. The percentage of patients with mesothelioma who have a history of occupational asbestos exposure is lower in studies that are based on review of medical records compared to studies based on a complete work history where 90% of mesothelioma has been attributed to asbestos exposure. [7] Among cohorts of asbestos-exposed workers, up to 10% of deaths have been attributed to mesothelioma.

Mesothelioma, continued...

The Michigan Cancer Registry collects data on the demographics of mesothelioma in Michigan. From 1995 through 2009 there were 1,687 Michigan residents reported to the Michigan Cancer Registry with invasive mesothelioma. Figure 12 shows the number of men and women diagnosed with mesothelioma by year, from 1985 to 2009. Approximately one quarter of the reports of mesothelioma occurred in women. Mesothelioma occurred predominantly among Caucasians (93.5%) compared to African Americans (5.6%). Approximately 1% were classified as "other" ancestry.

Figure 13 shows the age at diagnosis separately for men and women. The peak age of occurrence of mesothelioma was for individuals 65 years and older for both men and women.

Figure 14 shows the distribution of the number of cases of mesothelioma among Michigan residents, by county. The south-east-and-central region of Michigan has the highest number of cases of mesothelioma. Figure 15 shows the average annual incidence rates of mesothelioma among Michigan residents, by county. The counties with the highest rates are: Midland (2.5 per 100,000); Bay (2.5 per 100,000); Saginaw (1.9 per 100,000); and St. Clair (1.8 per 100,000). The annual average mesothelioma incidence rate for 1995-2009 in Michigan was 1.1 cases per 100,000.

FIGURE 12
Number of Men and Women in Michigan Diagnosed with Mesothelioma: 1985-2009

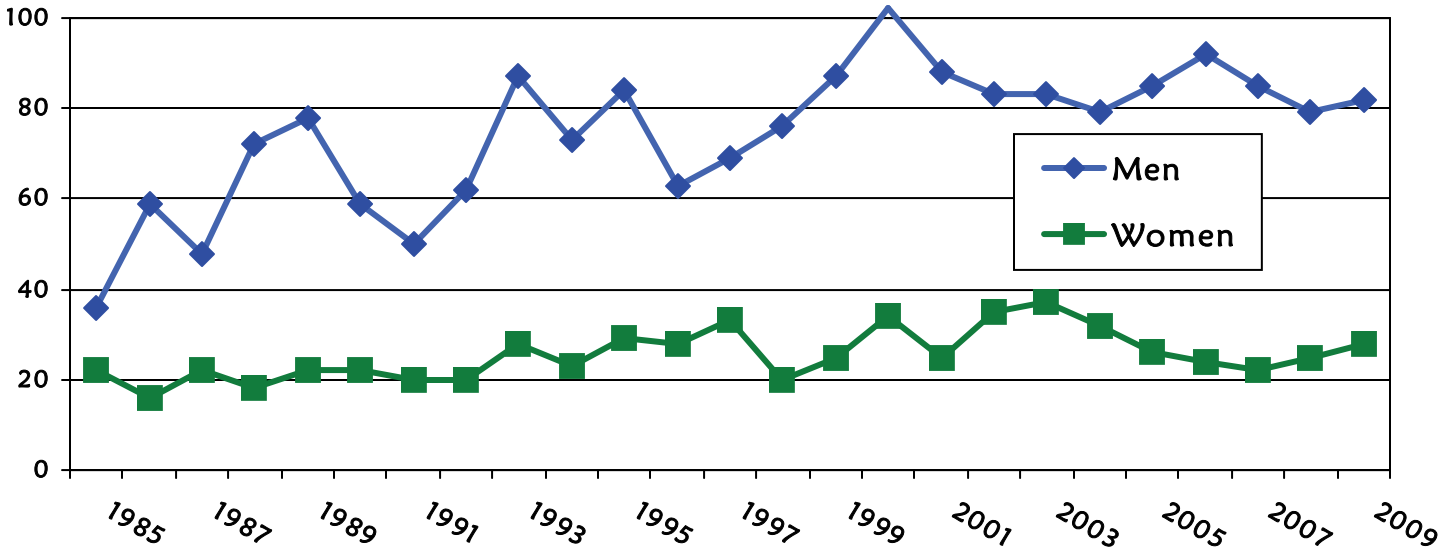


FIGURE 13
Cases of Mesothelioma in Michigan by Gender and Age at Diagnosis: 1985-2009

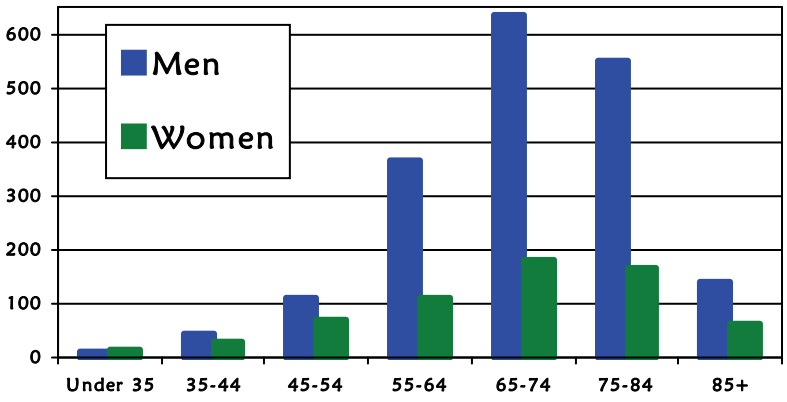


FIGURE 14

Distribution of MI Residents Diagnosed with Mesothelioma by County: 1995-2009

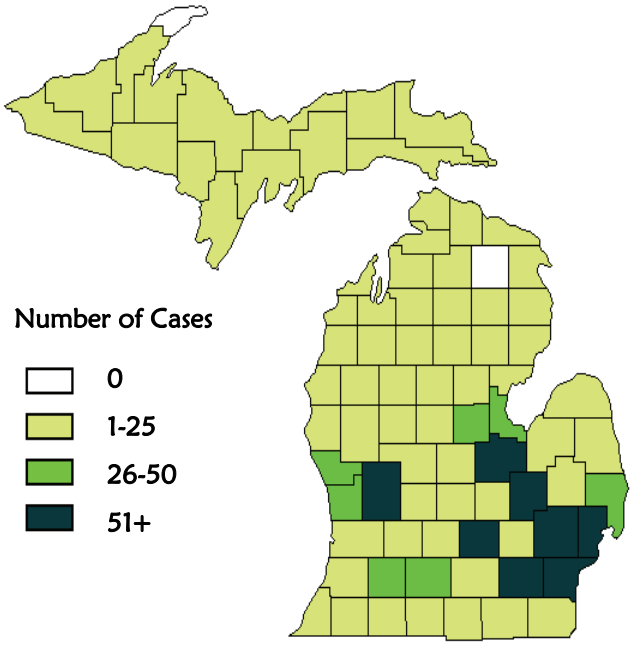
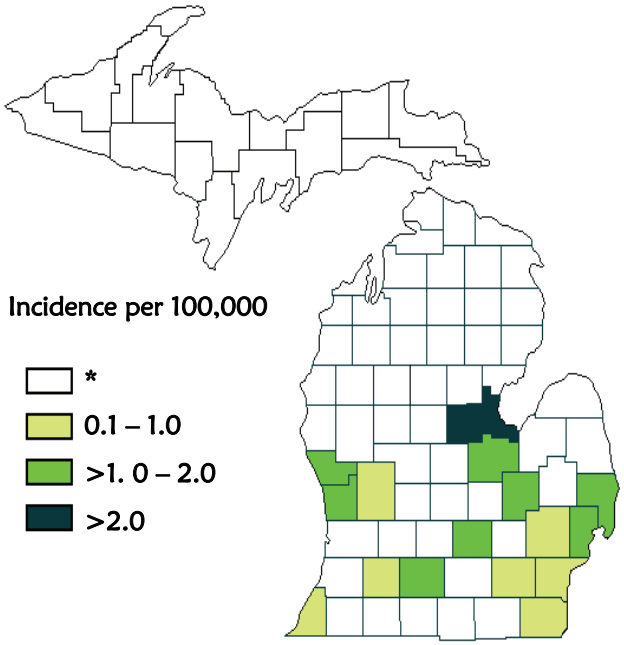


FIGURE 15

Age-Adjusted Incidence Rates of Mesothelioma Among Michigan Residents, by County



*Rate statistically unreliable

Other Work-Related Lung Diseases

2011 is the first year of data collection for other lung diseases (OLDS). Other lung diseases from exposures in the workplace include breathing problems that are not necessarily chronic in nature, in addition to those that are chronic. Conditions that we identified in the first year of OLDS surveillance include acute conditions such as chemical irritation/irritative bronchitis where an acute exposure results in a health provider visit and limited treatment, with resolution of symptoms. Other conditions covered include smoke inhalation from fires or burning material, infectious agents from exposures at work, and chemical pneumonitis. Chronic conditions are also included in this grouping, with other pneumoconioises, hard metal lung disease and coal workers' pneumoconiosis. A physician board-certified in internal and occupational/environmental medicine reviews all medical records to determine first whether the condition is work-related and secondly the nature of the illness and classification into general categories of disease. In cases where the work-relatedness of the exposure is unclear, additional medical records may be obtained and/or a patient interview completed. In future years of OLDS surveillance we expect to identify additional categories of OLDS as we expand our efforts to identify the best reporting sources for these conditions.

Similar to delays in reporting cases of silicosis, the OLDS reports are incomplete due to delays in hospital reporting. Table 11 shows the primary reporting source of the 139 persons confirmed with OLDS in 2011. Hospital reports are the primary source of identification of patients, with 56 (40%) of OLDS patients identified solely through the hospitals, followed by 44 (32%) reported through workers' compensation, 27 (19%) through the Poison Control Center, six (4%) reported by physicians, three (2%) through death certificates, two (1%) self-reports and one (1%) reported by a MIOSHA field staff person.

The following statistics are based on the 139 cases of other lung diseases confirmed from 2011.

TABLE 11
Characteristics of 139 OLDS Cases Reported in 2011

DISEASE	#	%	REPORTING SOURCE	#	%
Chemical Irritation/Irritative Bronchitis	63	45	Hospital	56	40
Smoke Inhalation	13	9	Workers' Compensation	44	32
Chemical Pneumonitis	10	7	Death Certificate	3	2
COPD	5	4	Poison Control Center	27	19
Hypersensitivity Pneumonitis	5	4	Physician Report	6	4
Infectious Agent	4	3	Self Report	2	1
Other Pneumoconiosis	2	1	MIOSHA Field Staff	1	1
Allergies/Allergic Rhinitis	2	1	**TOTAL**	**139**	**100**
Lung Trauma	2	1			
ARDS	1	1		**MEAN**	**RANGE**
Coal Workers' Pneumoconiosis	1	1	**AGE**	39	17-89
Pulmonary Embolism	1	1			
Respiratory Bronchiolitis	1	1	**RACE**	**#**	**%**
Hard Metal Lung Disease	1	1	White	29	85
Respiratory Illness NOS	28	20	Black	2	6
TOTAL	**139**	**100**	Other	3	9
			TOTAL	**34**	**100**
SMOKING STATUS	**#**	**%**	(Unknown, n=105)		
Current Cigarette Smoker	14	40			
Ex Cigarette Smoker	3	8	**VITAL STATUS**	**#**	**%**
Never Smoked Cigarettes	18	51	Alive	136	98
TOTAL (Unknown, n=104)	**35**	**100**	Deceased*	3	2
			TOTAL	**139**	**100**
GENDER	**#**	**%**	* COD: 2 Farmers died from		
Male	84	60	Hypersensitivity Pneumonitis		
Female	55	40	and 1 Minister died of		
TOTAL	**139**	**100**	Pneumoconiosis, Unspecified.		

Disease Category

Sixty-three of the OLDS cases were classified as chemical irritation/irritative bronchitis, 13 suffered from smoke inhalation, 10 had chemical pneumonitis, five each had chronic obstructive pulmonary disease (COPD) or hypersensitivity pneumonitis, two each had another pneumoconiosis (not asbestosis or silicosis), allergic rhinitis or lung trauma, one each had acute respiratory distress syndrome (ARDS), coal workers' pneumoconiosis, a pulmonary embolism, respiratory bronchiolitis, or hard metal lung disease. An additional 28 had definite work-related respiratory illness that could not be classified more specifically.

The following case narratives describe some of the exposures and symptoms related to the OLDS cases reported in 2011:

Chemical Pneumonitis: (1) A male subcontractor in his 40s was refinishing bathtubs at a hotel and was exposed to muriatic acid. (2) A male in his 30s was exposed to chlorine at the manufacturing plant where he works. (3) A male sheet metal worker in his 40s was welding at work without a respirator.

Chemical Irritation/Irritative Bronchitis: (1) A female water treatment plant operator in her 50s was exposed to a chemical cloud of chlorine and fluoride. (2) A male pool maintenance man in his 60s dropped a 10 gallon container of chlorine, which then splashed on him. (3) A female in her 50s inhaled dry cleaner fumes at the laundry shop where she worked. (4) A male maintenance worker in his 20s worked at a plastic parts manufacturing plant where he was exposed to floor wax and floor stripper. (5) A female farm hand in her teens mixed lime powder with hay without wearing a mask.

Smoke Inhalation: (1) A male fire fighter in his 20s breathed smoke and fire extinguishing chemicals while fighting a fire. (2) A male fire fighter in his 30s was exposed to heavy smoke while putting out a fire. (3) A male tow truck driver in his 20s was exposed to fumes from a car battery that caught on fire.

Gender

Eighty-four (60%) of the persons with OLDS were men; the other 55 (40%) were women.

Race

Twenty-nine (85%) of the persons with OLDS were white, two (6%) were African American, and three (2%) were listed as "other ancestry". The race on 105 individuals was unknown.

Age

The average age of the OLDS cases was 39, ranging from 17 to 89 years of age.

Smoking Status

Fourteen (40%) of the OLDS cases were current smokers and three (8%) were ex-cigarette smokers. Eighteen (51%) individuals had never smoked cigarettes. There were 104 cases with unknown smoking status.

Vital Status

Three individuals were deceased. Two were farmers who died from hypersensitivity pneumonitis and one was a minister who died from a pneumoconiosis.

Type of Industry

Table 12 shows the primary type of industry where exposure occurred among the OLDS cases. The predominant industry where individuals were exposed was manufacturing with 26 cases (19%), followed by 14 cases (10%) working in public administration, 12 cases (9%) working in health care and social assistance and 11 cases (8%) each in construction and transportation and warehousing.

TABLE 12
Primary Industrial Exposure for OLDS Cases Reported in 2011

2002 North American Industry Classification System		#	%
11	Agriculture, Forestry, Fishing and Hunting	7	5
21	Mining	0	--
22	Utilities	1	1
23	Construction	11	8
31-33	Manufacturing	26	19
42	Wholesale Trade	0	--
44-45	Retail Trade	10	7
48-49	Transportation and Warehousing	11	8
51	Information	0	--
52	Finance and Insurance	0	--
53	Real Estate and Rental and Leasing	1	1
54	Professional, Scientific, and Technical Services	0	--
55	Management of Companies and Enterprises	0	--
56	Administrative and Support and Waste Management and Remediation Services	10	7
61	Educational Services	6	4
62	Health Care and Social Assistance	12	9
71	Arts, Entertainment, and Recreation	2	1
72	Accommodation and Food Services	7	5
81	Other Services (except Public Administration)	7	5
92	Public Administration	14	10
00	Unknown	14	10
TOTAL		139	100

MIOSHA Inspections-Industrial Hygiene Results

The 139 individuals with OLDS worked at 136 different facilities. Inspections were performed at four of these facilities. The following describes each of the inspections:

Carbide Tool Fabrication: an inspection looked at cobalt exposures based on a case of hard metal lung disease. The MIOSHA inspector sampled for cobalt metal dust and found levels below the MIOSHA Permissible Exposure Limit (PEL) for an 8-hour time-weighted average. Three co-workers of the index case were interviewed for respiratory symptoms; none of the co-workers experienced any breathing difficulties. The company was found to be in violation of MIOSHAs Hazard Communication Standard, and cited for not providing employees with effective training and information on the chemicals in their work area at the time of their initial assignment.

A second inspection occurred at the above company's second Carbide Tool Fabrication plant, based on the same index case. At this location, one cobalt measurement was found to be above the MIOSHA PEL of 0.05 mg/m^3. The sample was 0.056 mg/m^3 while dry grinding was being done. The company was cited for violation of the Hazard Communication Standard, with employees not being provided with effective training. The company was also cited for employee exposure to unguarded belts and pulleys, an unguarded power transmission, and for lack of training of employees on the use of respirators. The MIOSHA inspector recommended the company use respirators until new local exhaust ventilation could be installed in the area of the cobalt overexposure. Four co-workers were interviewed during this inspection; none of the employees reported any breathing problems.

A third inspection was at a Wood Products Manufacturing Plant based on a case of chemical pneumonitis. Employees were exposed to a variety of hard and soft wood dust at the facility. The MIOSHA inspector found wood dust exposures below the PEL. There were no citations from this inspection. However, the inspector noted the use of compressed air to blow down the work tables, and did provide several recommendations to the company. The inspector recommended the company install local exhaust ventilation (LEV) on saws to decrease the wood dust in the air. He also recommended the installation of a mechanical make-up air system to balance the air removed by the LEV. Finally, the inspector recommended the use of N-95 dust masks along with appropriate training of employees. Sixteen questionnaires of co-workers were completed, two individuals reported daily or weekly breathing problems in relation to work.

The fourth inspection was based on an individual with chemical irritation at a chemical manufacturing plant. Various chemicals were sampled, including toluene, caustics, acids, trichloroethene, hydrogen peroxide and silicon carbide dust. All sampling indicated exposures below the PELs. The inspector did recommend the repair of nonfunctional leak detectors for titanium tetrachloride and hydrogen gas. He also recommended the company install digital monitoring devices for the byproducts of titanium tetrachloride (hydrogen chloride and chlorine). The company was cited for violations including the absence of a suitable eye wash station, lack of a written respiratory protection program, lack of labeling of pipes containing hazardous chemicals, lack of maintenance of material safety data sheets, and deficiencies in hazard communication.

Discussion

The main characteristics of the individuals reported during Michigan's 20+ years of silicosis surveillance are that they are elderly men who mainly worked in foundries in three counties. The age distribution is similar to that reported in the 1950s.[8] The older age of the patient (average year of birth, 1923) is secondary to the chronic nature of the disease and the typical long exposure to silica that is required to develop the disease (average 28 years of exposure to silica).

However, we continue to receive reports of individuals with short-term exposure, who began work in the 1970s, 1980s, 1990s and one in the 2000s. Overall, 86 (8.2%) silicosis cases worked for less than 10 years (data not shown). Ninety (8.6%) of the 1,049 individuals with known decade of hire began work in the 1970s, 1980s, 1990s or 2000s; 26 of them had worked for less than ten years. Individuals working since the 1970s were more likely to have done sandblasting than those who began working with silica before 1970 (49% vs. 34%). Of the 20 people who first were exposed to silica since the 1980s, four worked in foundries, two were buffing and polishing metal, two worked in auto

manufacturing, two did cement work, one worked in mineral processing, one worked in a dental laboratory, one was a heavy equipment operator who did excavating, one was a painter, one worked as a miner in gold fields in the Southwest, one did welding, one owned an auto repair shop, one was in construction, one worked in a boiler fabrication shop, and one worked for a small sandpaper manufacturing operation.

African American men are over represented (40.0%). This reflects previous hiring practices in foundries.[9] African American workers consistently had higher incidence rates of silicosis than their white counterparts in the counties where rates were compared between these groups (see Table 4). Overall for the state, the incidence rate of silicosis among African American workers was 8.4 per 100,000 versus 1.5 per 100,000 for white workers (a 5.6-fold greater incidence).

The individuals reported generally have advanced disease: 267 (25.0%) with progressive massive fibrosis and another 383 (35.8%) with advanced simple silicosis (category 2 or 3). Approximately 64% of the reported patients have reduced breathing tests, including both restrictive and obstructive changes. Obstructive changes, although more prevalent among individuals who had smoked cigarettes, were found in half of the individuals who had never smoked cigarettes (Table 3). Twenty-two percent have had either tuberculosis or a positive skin test indicating infection with the mycobacterium that causes tuberculosis. Despite the severity of their disease, 61% had not applied for workers' compensation.

The reports of Michigan silicotics having obstructive lung changes is consistent with published reports of increased chronic obstructive pulmonary disease (COPD) among silicotics, as well as among individuals without silicosis who have had silica exposure.[10] Individuals with silicosis are at risk of developing pulmonary hypertension, clinically significant bronchitis and chronic obstructive pulmonary disease.[11]

Hospitals are the primary reporting source of the patients identified through Michigan's surveillance system. Hospital discharge reporting is a more cost-effective method for identifying silica problem worksites than physician reporting, death certificates or workers' compensation data.[12] A comprehensive surveillance system for silicosis that combines all four reporting sources is as good if not better return for public health dollars invested as most existing public health programs.[12]

Individuals with silicosis have an increased morbidity and mortality for both malignant and non-malignant respiratory disease.[1,13] The increased risk for death is found both in patients who ever or never smoked cigarettes.[1] Individuals with silicosis also have an increased risk of developing connective tissue disease, particularly rheumatoid arthritis [14,15] as well as an increased risk of developing chronic renal disease, especially ANCA positive disease.[16,17,18]

The national employer-based surveillance system was not designed to count chronic diseases such as silicosis. We have previously estimated that there were 3,600 to 7,300 newly diagnosed cases of silicosis each year in the United States from 1987 – 1996.[2] Using the same methodology for the time period 1997 – 2003 we estimate there were 5,586 – 11,674 newly diagnosed cases of silicosis per year in the United States. Using an alternative approach with hospital discharge data we estimate there were 1,372 – 2,867 newly diagnosed cases of silicosis per year in the United States. Although the estimate based on death certificates is approximately fourfold greater than the one based on hospital discharge data, we believe that the true number of new cases of silicosis is closer to these larger estimates than using the actual number of death certificates that mention silicosis (~150 per year) or the Bureau of Labor Statistics estimate based on employer reporting, which in 1999 reported only 2,200 cases for <u>all</u> dust diseases of the lung, including asbestosis and coal worker's pneumoconiosis in addition to silicosis.

Industrial hygiene inspections reveal violations of the exposure standard for silica in 36.1% of the facilities where sampling was done. However, follow-up inspections of these same companies have shown a significant decrease in silica exposures. Companies not in compliance with the silica standard are requiring their workers to use powered air-purifying respirators or air-line respirators. However, because of an inadequate or absent medical surveillance program in 88.4% of the facilities, there is no way to monitor the adequacy of these controls in terms of health outcomes.

The use of silica was down to 40% of abrasive blasting companies in 2011 compared to 89% of abrasive-using companies in 1995 (Figure 7). The survey also revealed the availability of a large variety of abrasive media being used in Michigan as alternatives to silica.

Silicosis remains an ongoing problem in Michigan with former foundry workers continuing to develop severe disease. Further, some Michigan workers will continue to be at risk of developing silicosis because of continued use of silica among abrasive blasters and inadequate controls in the construction industry and at foundries currently in operation. Even without the development of silicosis, silica exposure is a risk factor for the development of lung cancer, connective tissue disease, tuberculosis and COPD.[10,13,19] These risks justify tighter work place controls for silica even if the number of new cases of silicosis continues to decline.

The number of Michigan ferrous foundry workers peaked in the 1970s at around 40,000, dropped to around 20,000 in the early 1980s, to 10,000 in the 1990s, and to approximately 4,000 in 2010 (Figure 6).

The incidence of silicosis has declined over the last 20 years in Michigan, which can be attributed to the closing of foundries, reduction of the workforce and improvement in engineering controls in the remaining foundries, and the substitution of alternative abrasives for silica in the abrasive blasting industry.

As we begin to identify other work-related lung diseases in our state, the patterns of these types of OLDS will emerge which will allow us to direct intervention efforts with educational materials and enforcement workplace inspections.

All hospital discharges/emergency department visits for asbestos-related disease were evaluated in calendar year 2009 with an ICD-9 code of 501 (asbestosis). A total of 796 individuals were identified for 2009. Most of these patients were men (95.1%), and white (92.6%). The average age was 74 years. The primary industry of these patients was limited. Of the 143 with known industry, construction (37.1%), manufacturing (28%) and public safety (14.0%) were the most commonly reported industries. Plumber/pipefitter was the most common occupation. Individuals diagnosed with asbestosis were from Wayne county (164 cases, 21.3%), Oakland (49 cases, 6.4%), Saginaw (31 cases, 4.0%), Macomb (30 cases, 3.9%), and Muskegon (25 cases, 3.2%). To date, there have been no cases identified who have had recent asbestos exposure. Future plans for the evaluation of asbestos-related disease are geared towards identifying cases with recent exposure to asbestos where a MIOSHA enforcement inspection may identify ongoing exposure.

The first year of OLDS surveillance resulted in the identification of a variety of respiratory illnesses from workplace exposures, as well as directing interventions through MIOSHA enforcement inspections. Future surveillance of OLDS cases will continue to identify workplaces where MIOSHA inspections are warranted. Other activities will focus on characterizing the nature and extent of the OLDS cases, and the identification of areas where education could benefit individuals who develop OLDS and to help prevent OLDS in others with similar workplaces and exposures. Based on the American Thoracic Society Consensus statement that "15% of COPD is likely to be work-related," we plan to initiate an additional focus of OLDS surveillance to attempt to identify work-related COPD. [20]

We are optimistic about the downward trend in reported silicosis cases but remain concerned about ongoing silica exposure and the increased risk of lung cancer, COPD, connective tissue disease, and kidney disease associated with silica exposure. Asbestos-related disease, both malignant and non-malignant, is the single most commonly diagnosed occupational lung disease. Targeting of smoking cessation programs and development of guidelines for the use of CT scans for screening for lung cancer in workers with a history of asbestos exposure is a high priority. Finally, collection of more information about the circumstances of how other types of occupational lung diseases are occurring is needed to develop strategies to reduce their incidence.

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