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2012 Annual report

Tracking Silicosis & Other work-related Lung Diseases in michigan

2012 ANNUAL REPORT TRACKING SILICOSIS & OTHER WORK-RELATED LUNG DISEASES IN MICHIGAN

Silicosis & Other Work-Related Lung Disease Surveillance Program

Michigan State University Department of Medicine

West Fee Hall
909 Fee Road, Room 117
East Lansing, MI 48824
517.353.1846

Kenneth D. Rosenman, MD
Mary Jo Reilly, MS

Michigan Department of Licensing & Regulatory Affairs (LARA)

PO Box 30649
Lansing, MI 48903

517.322.1817

Martha B. Yoder
Director MIOSHA

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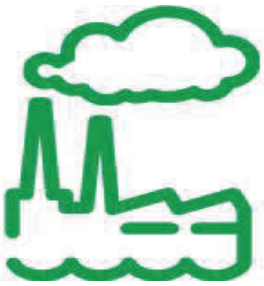
We sincerely appreciate the commitment of those health care providers who understand the public health significance of diagnosing a patient with an occupational illness, as well as the Michigan employees who took the time to share their experiences about their work and subsequent development of work-related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

Summary

This is the 21st annual report on silicosis in Michigan. This is the 2nd year of 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 7.8 cases per 100,000 workers. Among white males the rate is 1.4 cases per 100,000 workers. Within specific counties in Michigan, the annual average incidence rates of silicosis range between two to 401 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...

- From 1985-2012, 1,135 silicosis cases have been identified through the Michigan tracking system.
- On average since 2000, 25 new cases of silicosis were reported to LARA each year.
- We estimate there were 67-139 adults in Michigan with silicosis who were not reported in 2012.
- Asbestos-related lung changes are the most common work-related lung disease in Michigan, identified through hospital discharge data, B-Readers, the courts and other sources.
- 191 cases of Other Work-Related Lung Disease (OLDS) were identified in 2012; chemical irritation/ irritative bronchitis, chemical pneumonitis and symptoms from smoke inhalation were among the conditions reported.
- MIOSHA enforcement inspections at two workplaces where an OLDS case was reported revealed violations of OSHA standards including Hazard Communication, but companies were generally within Permissible Limits for exposures associated with their lung diseases.

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
- **Clinical Laboratories** for specific IgE allergy testing

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

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 1985-2012, **asbestos-related lung disease and mesothelioma**, and **all other OLDS surveillance** for calendar year 2012.

REPORTS OF SILICOSIS

Table 1 shows that 1,135 people were confirmed with silicosis between 1985—2012. Figure 1 shows the number of confirmed silicosis cases by year, for 1987—2012. Figure 2 shows the overlap of reporting sources.

TABLE 1
Year and Reporting Source for 1,135 Confirmed Silicosis Cases: 1985-2012

	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	19	0	0	0
2011**	0	11	0	0	0
2012**	0	10	0	0	0
TOTAL	165	793	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 2011 and 2012.

FIGURE 1
Confirmed Silicosis Cases by Year Reported

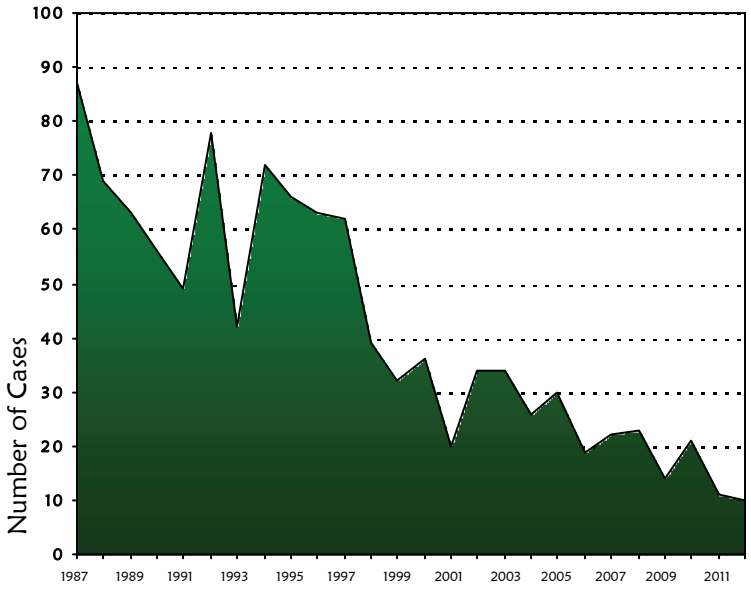
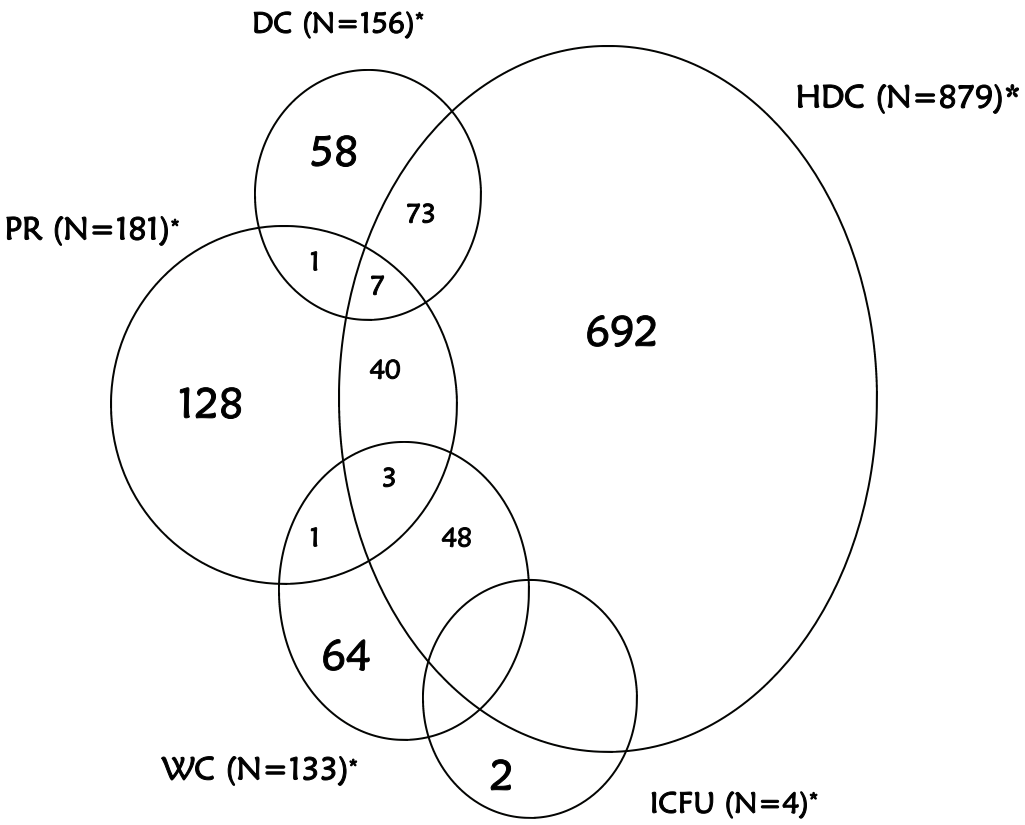


FIGURE 2
Overlap of Reporting Sources for 1,135 Confirmed Silicosis Patients: 1985-2012



*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 25 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 26, 2%
- Men 1,109, 98%

YEAR OF BIRTH

- Range 1888—1971
- Average 1923

RACE

- Caucasian 647, 57%
- African American 447, 40%
- Alaskan/American Ind. 1, <1%
- Asian 2, <1%
- Other 30, 3%
- Unknown 8

ANNUAL INCIDENCE RATE

- African American 7.8
- Caucasian 1.4

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 1987-2010. Denominator Source: 2000 Census population data by race, age 40 and older.

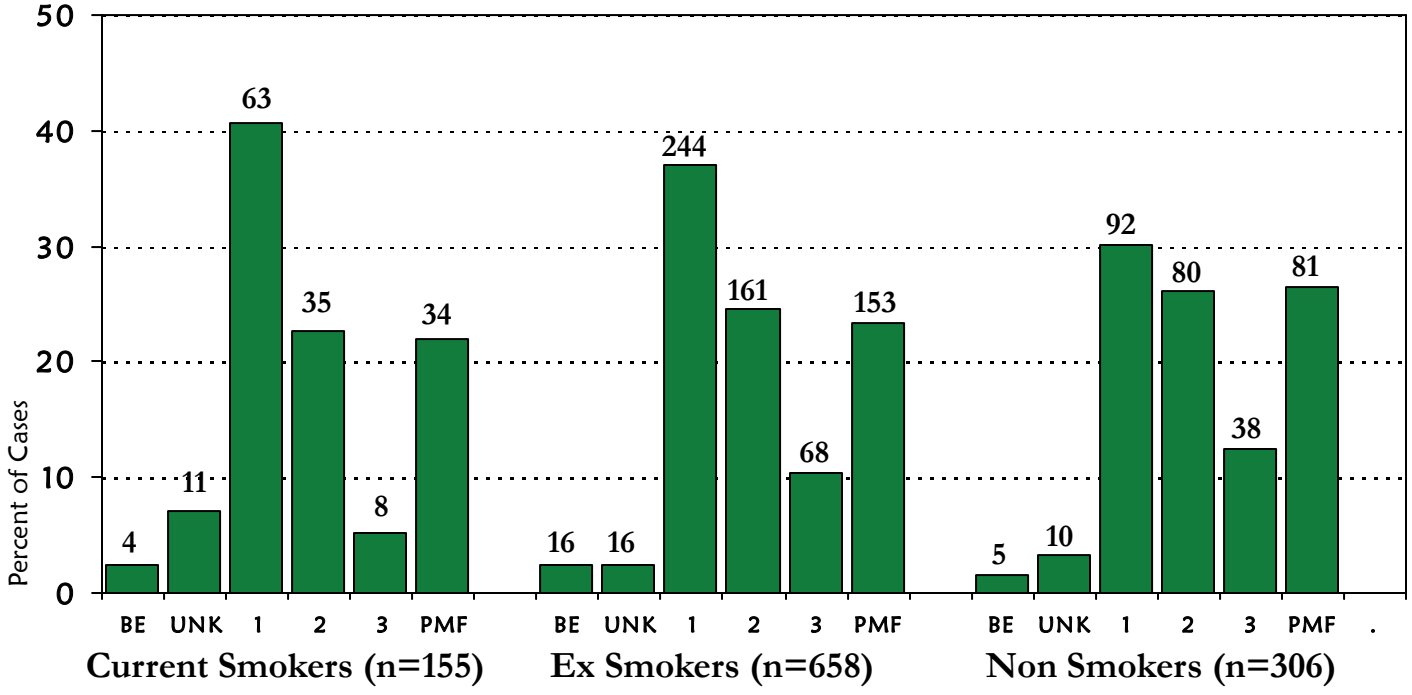
Medical Results-Silicosis

Overall 799 (70.4%) of the people with silicosis had simple silicosis and 272 (24.0%) had progressive massive fibrosis. Twenty-six (2.3%) silicotics had normal x-rays with lung biopsy evidence. Thirty-eight (3.3%) individuals had x-ray reports which were consistent with silicosis but the actual radiograph could not be obtained to classify.

For the 1,119 silicosis cases with known smoking history, 306 (27.3%) of the people with silicosis never smoked cigarettes, 658 (58.8%) had quit, and 155 (13.9%) 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 67-84% 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: 1985–2012**



*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: 1,119. 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: 1985-2012

	Percent Predicted FVC***					
	<60%		60-79%		>=80%	
X-Ray Results*	Ever Smoked	Never Smoked	Ever Smoked	Never Smoked	Ever Smoked	Never Smoked
	%	%	%	%	%	%
Biopsy Evidence	7	--	43	67	50	33
Unk Severity	41	40	36	20	23	40
Category 1	23	30	35	29	42	41
Category 2	30	39	36	32	34	30
Category 3	26	67	43	14	31	19
PMF	38	38	33	32	29	30
Total**	29	39	36	29	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: 718. Information was missing for 417 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: 1985-2012

	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	14	--	50	50	36	--
Unk Severity	11	--	11	--	22	80	56	20
Category 1	10	2	21	4	36	36	33	58
Category 2	4	4	21	16	40	29	34	51
Category 3	3	5	18	--	13	30	67	65
PMF	16	6	32	22	30	35	22	37
Total**	9	4	23	11	34	35	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: 688. Information was missing for 447 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. Yellow-highlighted rates are for counties where both white and African American cases were reported. The highest rates were among black males in Shiawassee (321 cases per 100,000), Muskegon (140 cases per 100,000), Saginaw (48 cases per 100,000), and Monroe (25 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: 1987-2010

	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	6.5	1		—
Alpena	7388	22	12.4	8		—	Lake	2817	2	3.0	251		—
Arenac	4168	1	1.0	62		—	Lapeer	18176	1	0.2	226		—
Baraga	1815	1	2.3	78		—	Lenawee	20192	4	0.8	573		—
Barry	12360	3	1.0	34		—	Livingston	32610	3	0.4	111		—
Bay	23674	7	1.2	226		—	**Macomb**	**156926**	**22**	**0.6**	**3233**	**7**	**9.0**
Benzie	3898	1	1.1	9		—	Manistee	5999	3	2.1	67		—
Berrien	**30479**	**7**	**1.0**	**3594**	**3**	**3.5**	Marquette	14199	14	4.1	224		—
Branch	9525	4	1.7	288		—	Mason	6683	1	0.6	41		—
Calhoun	**25345**	**25**	**4.1**	**2650**	**13**	**20.4**	Menominee	6054	11	7.6	2		—
Charlevoix	5942	3	2.1	5		—	Midland	16605	1	0.3	128		—
Chippewa	7286	1	0.6	616		—	**Monroe**	**29452**	**7**	**1.0**	**497**	**3**	**25.2**
Delta	9045	3	1.4	5		—	Montcalm	12433	3	1.0	335		—
Dickinson	6419	1	0.6	5		—	Montmorency	2957	1	1.4	3		—
Eaton	20377	3	0.6	781		—	**Muskegon**	**30132**	**110**	**15.2**	**3564**	**120**	**140.3**
Genesee	**69596**	**10**	**0.6**	**13423**	**4**	**1.2**	**Oakland**	**216359**	**13**	**0.3**	**20085**	**6**	**1.2**
Gladwin	6615	1	0.6	8		—	**Ottawa**	**41916**	**4**	**0.4**	**270**	**1**	**15.4**
Gogebic	4353	3	2.9	22		—	**Saginaw**	**36097**	**62**	**7.2**	**5936**	**68**	**47.7**
Gd Traverse	16451	1	0.3	57		—	**St. Clair**	**33209**	**5**	**0.6**	**623**	**1**	**6.7**
Gratiot	8356	1	0.5	371		—	**St. Joseph**	**12266**	**3**	**1.0**	**251**	**1**	**16.6**
Hillsdale	9857	7	3.0	36		—	Sanilac	9753	2	0.9	23		—
Ingham	41166	9	0.9	3987		—	Schoolcraft	2121	1	2.0	18		—
Iosco	7280	1	0.6	30		—	**Shiawassee**	**14737**	**3**	**0.8**	**26**	**2**	**320.5**
Iron	3531	1	1.2	28		—	Van Buren	15129	2	0.6	808		—
Jackson	**31380**	**3**	**0.4**	**2685**	**2**	**3.1**	Washtenaw	47535	6	0.5	5758		—
Kalamazoo	39985	3	0.3	3004		—	**Wayne**	**236472**	**121**	**2.1**	**134974**	**156**	**4.8**
Kent	**93136**	**14**	**0.6**	**6768**	**2**	**1.2**	Wexford	6478	2	1.3	6		—

*Rate per 100,000 among Caucasian men age 40+. Numerator is the average number of Caucasian males with silicosis for the years 1987 – 2010; 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 – 2010; 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 2012. 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.

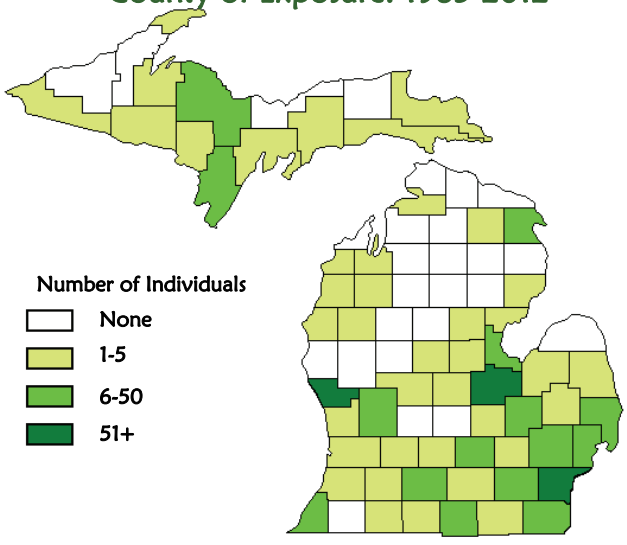
Although silicosis typically occurs after a long duration of exposure to silica, some patients develop silicosis after a relatively short period of time because of the severity of that exposure. The average year of hire is 1950, ranging from 1910 to 2007. Two individuals began working in the 2000s, four began working in the 1990s, 18 in the 1980s, 73 in the 1970s and 166 in the 1960s. The average number of years worked at a silica-exposed job was 27.3 years.

TABLE 5
Primary Industrial Exposure for Confirmed Silicosis Patients: 1985-2012

2002 North American Industry Classification System		#	%
11	Agriculture, Forestry, Fishing, & Hunting	2	0.2
21	Mining	41	3.6
22	Utilities	1	0.1
23	Construction	90	7.9
31-33	Manufacturing	973	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	4	0.4
Total		1,135	100.1*

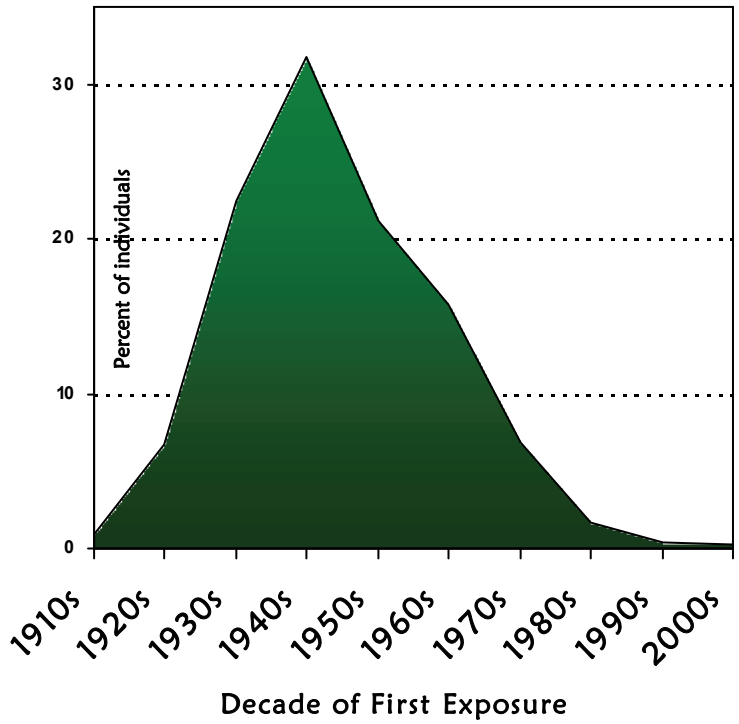
*Percentage does not add to 100 due to rounding.

FIGURE 4
Distribution of Confirmed Silicosis Cases by County of Exposure: 1985-2012*



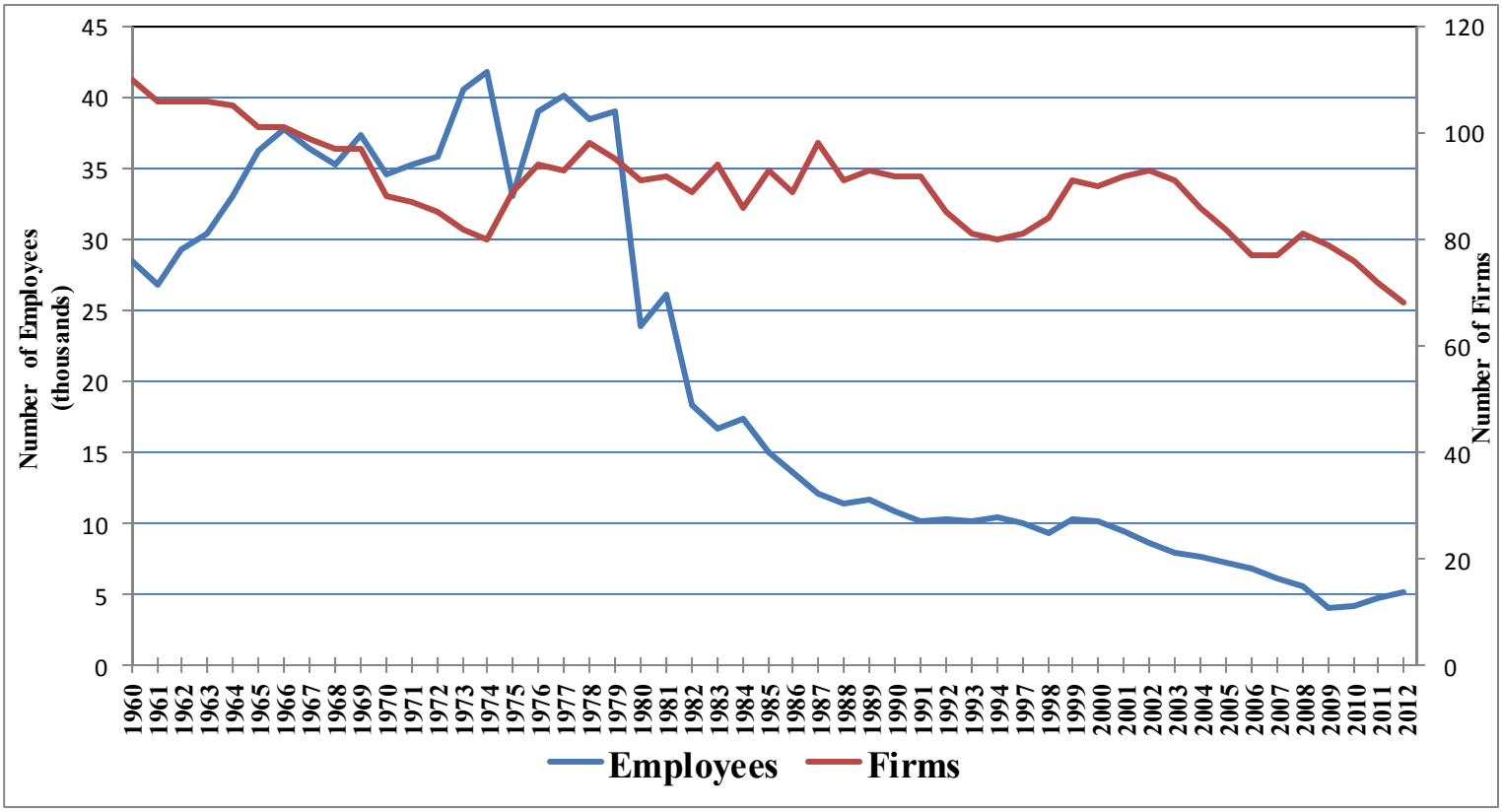
*Seventy-two individuals were exposed to silica out-of-state, and 24 individuals had an unknown county of exposure.

FIGURE 5
Distribution of Decade when Silica Exposure Began for Confirmed Silicosis Cases: 1985-2012*



*Decade of first exposure was unknown for 68 individuals with silicosis.

FIGURE 6
Michigan Ferrous Foundries 1960-2012



Industrial Hygiene Results-Silicosis

The 1,135 individuals with silicosis were exposed to silica in 460 facilities (Table 6). Inspections were performed by MIOSHA at 87 (18.9%) of these facilities. One hundred forty-eight (32.2%) facilities were no longer in operation, 66 (14.3%) were located out of state, 26 (5.7%) facilities no longer used silica, 65 (14.1%) workplaces were in the construction industry, seven (1.5%) were covered by the Mine Safety and Health Administration jurisdiction, and for 61 (13.3%) the specific location where the silica exposure occurred was unknown. There were no facilities scheduled for inspection.

Air sampling was conducted in 62 of the 87 facilities inspected (Table 7). Thirty-six of 62 (58.1%) facilities were above the National Institute for Occupational Safety and Health (NIOSH) recommended exposure limit for silica.

Twenty-two of the 62 (35.5%) were above the enforceable MIOSHA permissible exposure limit for silica. Another two (3.2%) 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 1,135 Confirmed Silicosis Cases were Exposed to Silica: 1985-2012

	Cases	Facilities	
Inspection Status	#	#	%
Inspection Completed	478	87	18.9
Scheduled for Inspection	0	0	—
MSHA* Jurisdiction	16	7	1.5
Facility Out of Business	414	148	32.2
Facility Out of State	70	66	14.3
Facility No Longer Uses Silica	31	26	5.7
Building Trade: No Inspection	65	65	14.1
Unknown	61	61	13.3
Total	1,135	460**	100.0

*MSHA= Mine Safety and Health Administration.
**Four facilities are related to one silicosis case's work history.

TABLE 7
MIOSHA Inspections of 87 Facilities of Silicosis Cases Exposed to Silica: 1985-2012

	Companies	
	#	%
Air Sampling Performed	62	
Above NIOSH* Rec Std for Silica	36	58.1
Above MIOSHA Enforceable Std for Silica	22	35.5
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 & Health.
**MIOSHA Michigan Occupational Safety & Health Administration.

Sandblasting-Silicosis

Three hundred two of the 848 individuals for whom sandblasting history was known (35.6%) stated they had done sandblasting as part of their work.

Proposed Silica Standard

On September 12, 2013 Federal OSHA proposed a comprehensive standard for exposure to silica. The full proposal published in the Federal Register is 232 pages, although the actual proposed standard is only 18 pages (www.osha.gov/FedReg_osha_pdf/FED20130912.pdf). The other 200+ pages cover background, regulatory history, benefits and economic impact. The Review of Health Effects Literature and Preliminary Quantitative Risk Assessment is another 483 pages, which includes 84 pages of references (www.osha.gov/silica/Combined_Background.pdf).

The current standard promulgated in 1971 allows an eight hour time weighted average of 100 $\mu g/m^3$ in general industry and 250-500 $\mu g/m^3$ in construction and shipyards. There are no requirements in the current standard for medical surveillance, exposure assessment, education or respiratory protection. The proposed standard would lower the eight hour time weighted average in general industry, construction and shipyards to 50 $\mu g/m^3$ as a gravimetric measurement of respirable silica. This level would replace the current formula that includes the crystalline silica content of the dust sampled and for construction and shipyards a conversion from particle counts. NIOSH first proposed lowering the allowable silica level to 50 $\mu g/m^3$ in 1974 and OSHA published an Advanced Notice of Proposed Rulemaking in December 1974 but OSHA did not pursue further action at that time. Subsequently, there has been an extensive amount of medical research on silica including its recognition as a carcinogen, a renal toxin and a risk factor for COPD and connective tissue disease.

Proposed Silica Standard, continued

Hearings on the proposed standard were held in Washington, DC for 14 days beginning March 18, 2014. Michigan surveillance data was used to make the following three points:

Point 1: Mortality from silicosis as collected and reported by the CDC in national statistics is an inadequate marker of the burden of silica's toxicity.

Point 2: Silica-related disease is a health disparity issue.

Point 3: OSHAs proposed comprehensive standard is needed to ensure that medical surveillance is provided to workers exposed to silica.

These three points will be further explained below:

Point 1: Current National Mortality Statistics are Inadequate as a Marker for the Burden of Silica.

- Silicosis is only listed on the death certificate of 14% of individuals with confirmed silicosis.

- In the last 25 years, the ratio of individuals with new onset silicosis who are living is 7.17 times that found on death certificates. The living-to-dead ratio has increased from 6.44 in 2003 [2] to 15.2 times in more recent years. A similar ratio and increase in the ratio of living-to-dead was found in New Jersey surveillance data, increasing from 5.97 to 11.5 times.

- Consistent with the increasing ratio of living-to-dead individuals with silicosis is that while the recording of silicosis has decreased on death certificates, the number of hospitalizations where silicosis is one of the discharge diagnoses has remained constant. In 1993, there were 2,028 hospitalizations nationwide with silicosis as one of the discharge diagnoses. In 2011 there were 2,082 hospitalizations, approximately 60 more. (Source: Nationwide Inpatient Sample. Agency for Healthcare Research and Quality (AHRQ), http://hcupnet.ahrq.gov/).

- The ratio of living-to-dead people with silicosis is not a function of silicosis being a benign condition but reflects the lack of familiarity by health care providers with silicosis and the lack of awareness of the patient's medical history by the health care provider who completes the disease information on the death certificate. Silicosis is listed as the cause of death in a small percentage of individuals who have an advance stage of silicosis, in those with progressive massive fibrosis only 18% and in those with category 3 profusion only 10%, while pneumonia, COPD, lung cancer and unspecified interstitial fibrosis or respiratory failure are more commonly listed, 35% and 51%, respectively. In other words, 53% of individuals with PMF and 61% of those with category 3 are dying from a respiratory condition as compared to the general population where approximately 10% would die from a respiratory condition.

- Silicosis is just one of multiple adverse health outcomes of silica exposure. As just discussed, silicosis mortality is a poor indicator of the occurrence of silicosis and even less useful as a marker of the frequency of lung cancer, COPD, kidney disease, connective tissue disease and tuberculosis. Some examples from Michigan research projects include: 1) 44 individuals from MI with silicosis who developed connective tissue diseases such as rheumatoid arthritis [4]; 2) 40% of the cases in the Michigan database have kidney dysfunction; and 3) Dose-response studies to silica have found adverse outcomes in the absence of silicosis. In a study of foundry workers in Indianapolis, where workers with silicosis were excluded from the analysis, a significant decrease in pulmonary function at the existing OSHA PEL was found [5].

- There are two aspects to the frequency of occurrence of disease 1) the risk of disease is based on the level of exposure and 2) the number of individuals at risk. One can attribute almost all the decrease seen in silicosis to a decrease in the population at risk: For example:

    1. The number of workers in Michigan foundries decreased 75% from 1973 to 1991. The number of cases identified in the Michigan surveillance system decreased 83% from 1993 to

Proposed Silica Standard, continued

2011, factoring in a 20-year latency for silicosis development.
2. The number of abrasive blasting companies in Michigan using silica decreased 71% from 125 to 36, from 1995-2011. The percent of abrasive companies using silica went from 89% to 43%, a 52% decrease.
3. The number of deaths nationwide from 1973 to 2008 went from 765 to 148, an 80% decrease.

Industries where there has been an increased number of workers exposed to silica, such as construction doing highway repair or in oil and gas hydraulic fracturing have not had sufficient time since the increase in employment for silicosis to develop and accordingly have not caused an increase in silicosis statistics.

Point 2: Silica-related disease is a health disparity issue.

- The disease is unevenly distributed across the US; minority populations who are more likely to work at higher risk jobs are at higher risk. Michigan data shows that the incidence of silicosis in African-Americans is 6 fold greater than in Caucasians.

Point 3: OSHA's proposed comprehensive standard is needed to ensure that medical surveillance is provided to workers exposed to silica.

- Although OSHA, NIOSH and the National Industrial Sand Association have encouraged silica users since the 1970's to provide medical surveillance for silica exposed workers, this is not happening. No Michigan abrasive blasting companies or any construction companies are known to have implemented these recommendations on medical surveillance and only 2.3% of Michigan foundries are following these medical surveillance recommendations.

Asbestos-Related Lung Disease and Mesothelioma

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

Figure 7 shows the number of individuals hospitalized in Michigan with asbestosis and silicosis from 1990 to 2012. Repeat admissions of the same individual within each calendar year are excluded from these counts of inpatient Hospital Discharge Data (HDC). For most of these patients, pneumoconiosis was not the primary discharge diagnosis listed on the discharge record. From 1993 to 2006, there has been a steady increase in the number of hospitalizations for asbestosis; from 2007-2012 the large increase in reports is due to the availability of additional secondary discharge diagnosis codes from up to six secondary codes through 2006 to up to 29 secondary diagnosis codes beginning in 2007 (Figure 7). The red line in Figure 7 for 2007—2012 shows that the number of asbestosis cases would have decreased if only up to six secondary discharge diagnoses had continued to be used.

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 2012 Work-Related Lung Disease Surveillance Report updates on asbestosis available at: http://www2a.cdc.gov/drds/WorldReportData/default.asp. [6]

Payment source from the Michigan Health and Hospital Association (MHA) is the source of data displayed in Figure 8. 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. [1,7] 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. Again, for this discharge data of payment source, there is increased availability of secondary discharge diagnosis codes since 2007.

FIGURE 7
Hospital Discharges of Inpatients with Asbestosis & Silicosis in Michigan: 1990— 2006 & 2007— 2012

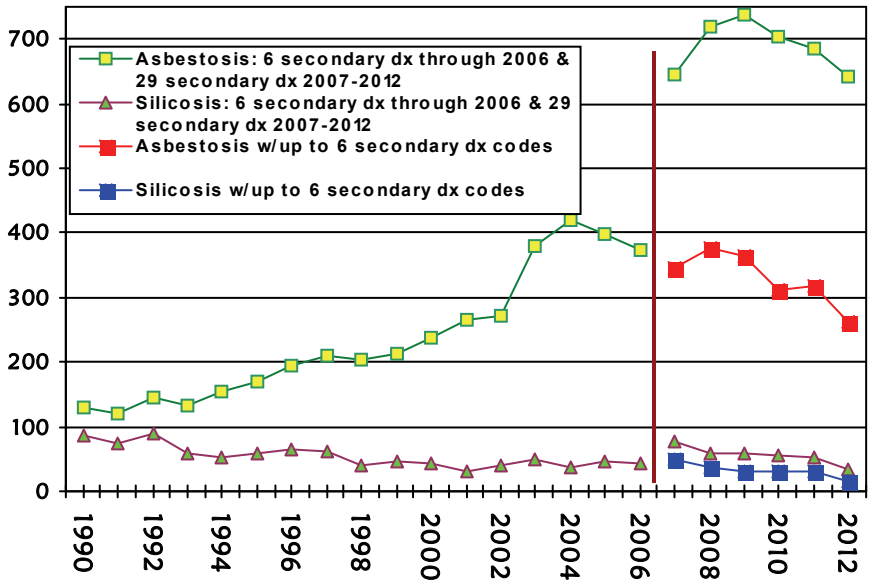
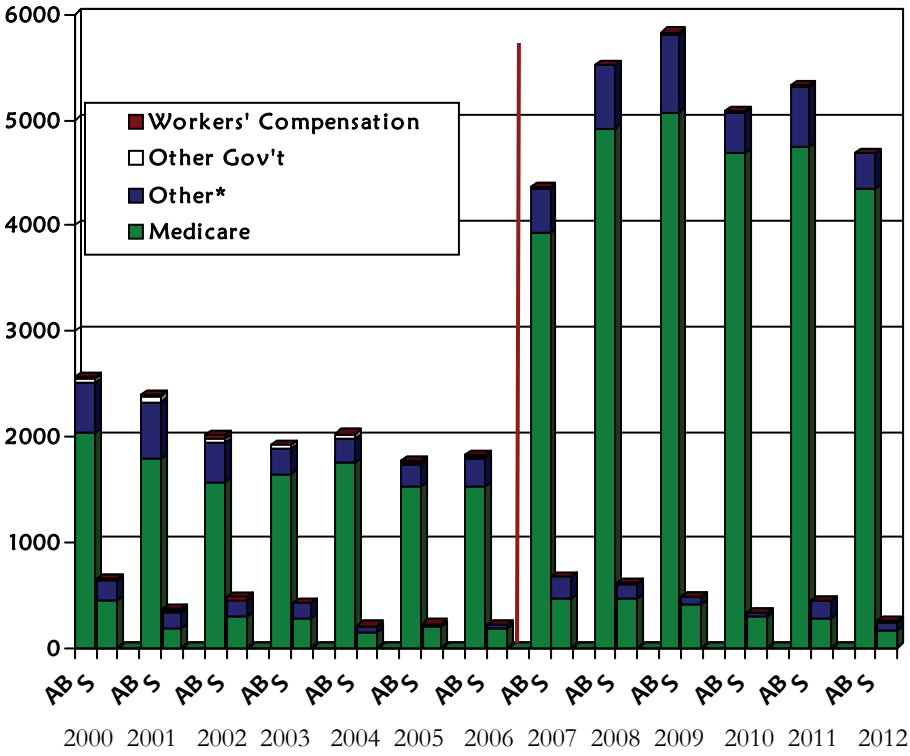


FIGURE 8
Days Hospitalized by Payment Source at Discharge for Asbestosis & Silicosis in Michigan: 2000-2006 & 2007-2012



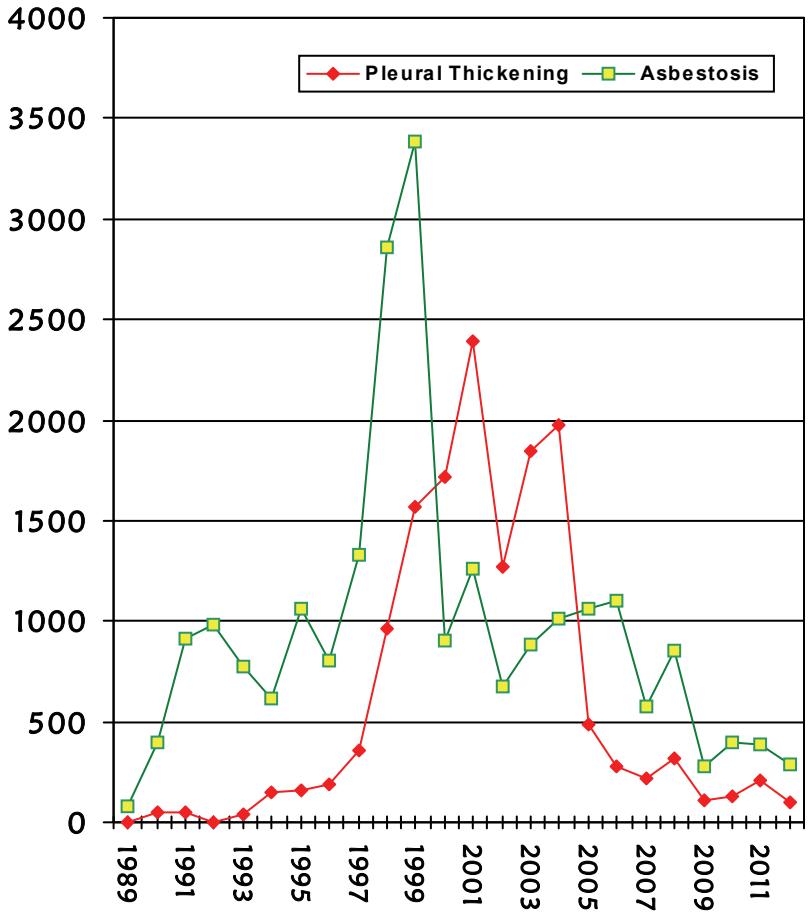
*Other includes: Medicaid, HMOs, PPOs, Other Insurance, Self-Pay and No-Charge payment sources.
AB–=Asbestosis, S=Silicosis.

In addition to identifying asbestos-related disease from HDC inpatient data, occupational disease reports submitted to LARA constitute another large source of reports. In fact, asbestos-related lung disease is the most common dust disease reported to LARA (Figure 9), through individual physicians certified as B-Readers, death certificates and the Michigan Courts. The newer OLDS surveillance initiative is yet another source of reports on patients with asbestos-related lung disease (see page 17). In 2012, for example, 17 cases of asbestos-related lung disease were identified through physician review of medical records. Some of these patients reported may overlap with those reported in the HDC data (Figure 7). The total number of asbestos-related cases would therefore be less than the combined total of HDC cases (Figure 7) along with the cases reported directly to LARA (Figure 9). It should be noted that the asbestos-related cases in Figure 7, Figure 9 and Table 8 may or may not overlap—they each represent a different way to obtain a count of asbestos-related disease from these three different sources.

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 8 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 191 (4%) of 4,419 x-rays reviewed in calendar year 2012, to a high of 3,640 (34%) of 10,575 x-rays reviewed in calendar year 1999. Table 8 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 9 Asbestos-Related Cases Reported from B-Readers, Death Certificates and the 3rd Judicial Court: 1989-2012



Mesothelioma

The association between exposure to asbestos and the risk of developing mesothelioma was first reported in the medical literature in 1943. [8] 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. [9] Among cohorts of asbestos-exposed workers, up to 10% of deaths have been attributed to mesothelioma.

The Michigan Cancer Registry collects data on the demographics of mesothelioma in Michigan. From 1996 through 2010 there were 1,713 Michigan residents reported to the Michigan Cancer Registry with invasive mesothelioma.

TABLE 8
Results of Annual Survey* of B-Readers in Michigan: 1995-2012

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
2012	6	139	52	191	4,419	4

*Actual chest radiograph interpretations were not submitted with the surveys.

Mesothelioma, continued...

Figure 10 shows the number of men and women diagnosed with mesothelioma by year, from 1985 to 2010. 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 11 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 12 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 13 shows the average annual incidence rates of mesothelioma among Michigan residents, by county. The counties with the highest rates are: Bay (2.4 per 100,000); Midland (2.3 per 100,000); St. Clair (1.9 per 100,000); and Saginaw (1.8 per 100,000). The annual average mesothelioma incidence rate for 1996-2010 in Michigan was 1.1 cases per 100,000.

FIGURE 10
Number of Men and Women in Michigan Diagnosed with Mesothelioma: 1985-2010

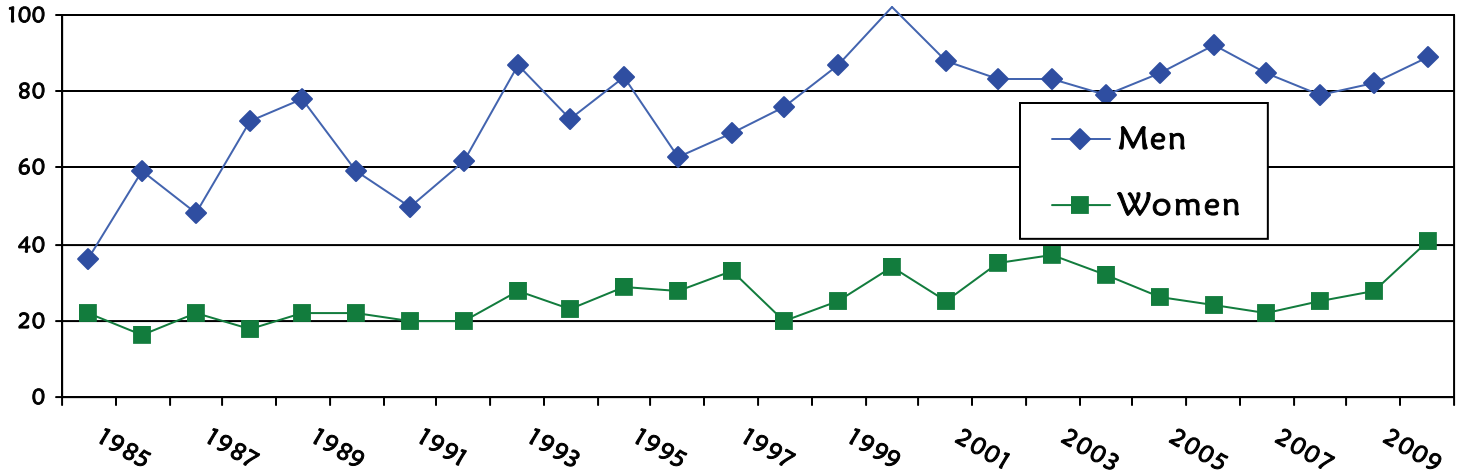


FIGURE 11
Cases of Mesothelioma in Michigan by Gender and Age at Diagnosis: 1985-2010

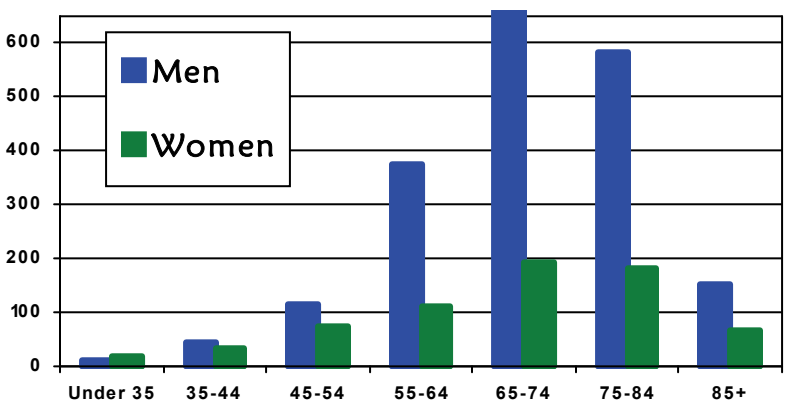


FIGURE 12

Distribution of MI Residents Diagnosed with Mesothelioma by County: 1996-2010

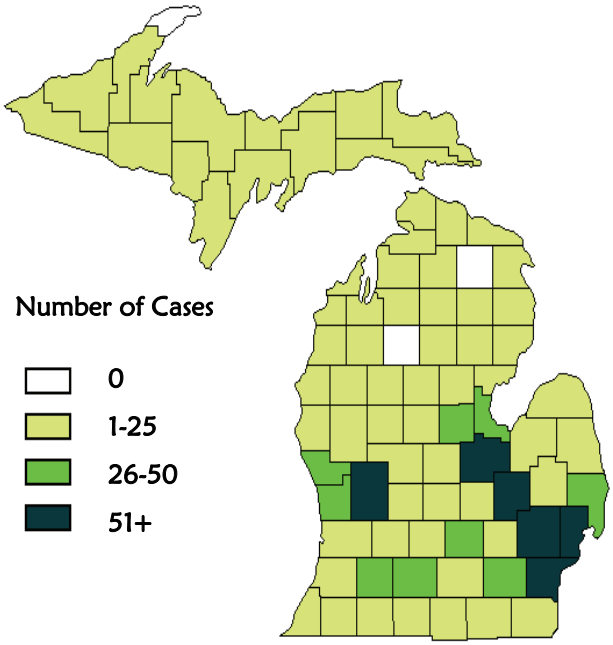
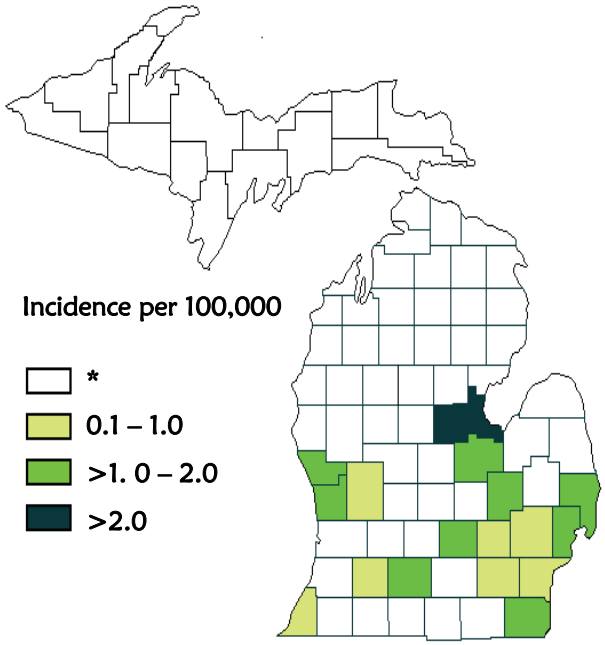


FIGURE 13

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



*Rate statistically unreliable

Other Work-Related Lung Diseases

2011 was 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 have identified since beginning 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 9 shows the primary reporting source of the 191 persons confirmed with OLDS in 2012. Hospital reports are the primary source of identification of patients, with 76 (40%) of OLDS patients identified solely through the hospitals, followed by 54 (28%) reported through Workers' Compensation, 34 (18%) through the Poison Control Center, 12 (6%) through death certificates, eight (4%) reported through labs, and seven (4%) reported by physicians.

The following statistics are based on the 191 cases of other lung diseases confirmed from 2012.

TABLE 9
Characteristics of 191 OLDS Cases Reported in 2012

DISEASE	#	%
Chemical Irritation/Irritative Bronchitis	80	42
Chemical Pneumonitis	20	10
Asbestos-Related Lung Disease	17	9
Smoke Inhalation	11	6
Allergies/Allergic Rhinitis	10	5
Infectious Agent	10	5
COPD	3	2
Hypersensitivity Pneumonitis	3	2
Hard Metal Lung Disease	2	1
Other Pneumoconiosis	2	1
Lung Cancer	1	<1
Pneumothorax	1	<1
Silo Related Disease	1	<1
Respiratory Illness NOS	30	16
TOTAL	**191**	**100**

REPORTING SOURCE	#	%
Hospital	76	40
Workers' Compensation	54	28
Poison Control Center	34	18
Death Certificate	12	6
Laboratory	8	4
Physician Report	7	4
TOTAL	**191**	**100**

	MEAN	RANGE
AGE in 2012 (years)	42	17-90

RACE	#	%
White	36	84
Black	7	16
TOTAL (Unknown, n=148)	**43**	**100**

SMOKING STATUS	#	%
Ever Smoked Cigarettes	26	45
Never Smoked Cigarettes	32	55
TOTAL (Unknown, n=133)	**58**	**100**

VITAL STATUS	#	%
Alive	179	94
Deceased*	12	6
TOTAL	**191**	**100**

GENDER	#	%
Male	118	62
Female	73	38
TOTAL	**191**	**100**

* COD: 1 government worker died from Hypersensitivity Pneumonitis and 11 individuals died from Asbestos-related disease.

Disease Category

Eighty of the OLDS cases were classified as chemical irritation/irritative bronchitis, 20 had chemical pneumonitis, 17 had asbestos-related lung disease, 11 suffered from smoke inhalation, 10 each had allergic rhinitis or a lung infection, three each had COPD or hypersensitivity pneumonitis, two each had hard metal lung disease or another pneumoconiosis (not asbestosis or silicosis), and one each had lung cancer, a pneumothorax or silo-related disease. An additional 30 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 2012:

Chemical Pneumonitis: (1) A male his 20s who worked for a sewer company was working in a sewer area. He was exposed to a release of chlorine gas and experienced cough, shortness of breath and vomiting. (2) A male in his 20s was exposed to a mixture of bleach and a drain cleaner at the fast food restaurant where he works. He experienced shortness of breath.

Chemical Irritation/Irritative Bronchitis: (1) A female in her late teens was exposed to fumes from the deep fryer at the fast food restaurant where she works. She experienced throat pain, sneezing and a cough. (2) A male bakery worker in his 20s inhaled fumes from boiling bagels in lye. He experienced light headedness and chest irritation. (3) A male law enforcement officer in his 30s was exposed to anhydrous ammonia during a drug bust at a meth lab. He experienced chest pain, a sore throat and nausea. (4) A female gas station attendant in her 20s was exposed to bathroom cleaner and experienced a cough.

Smoke Inhalation: (1) A male auto parts store worker in his 50s was exposed to smoke from a grass fire near his workplace. (2) A male fire fighter in his 20s was exposed to smoke from a barn fire and experienced shortness of breath and chest pain.

Gender

One hundred eighteen (62%) of the persons with OLDS were men; the other 73 (38%) were women.

Race

Thirty-six (84%) of the persons with OLDS were white, and seven (16%) were African American. The race on 148 individuals was unknown.

Age

The average age of the OLDS cases was 42, ranging from 17 to 90 years of age.

Smoking Status

Twenty-six (45%) of the OLDS cases were current or ever smokers. Thirty-two (55%) individuals had never smoked cigarettes. There were 133 cases with unknown smoking status.

Vital Status

Twelve individuals were deceased. One was a government worker who died from hypersensitivity pneumonitis and 12 died from asbestos-related lung disease. The asbestos-related deaths had worked in a variety of occupations including plumbing and pipefitting, boiler repair, a power plant, the rail roads, and other construction and manufacturing jobs.

Type of Industry

Table 10 shows the primary type of industry where exposure occurred among the OLDS cases. The predominant industry where individuals were exposed was manufacturing with 42 cases (22%), followed by 20 cases (10%) working in health care and social assistance, 14 cases (7%) working in public administration and 11 cases (6%) each in professional/scientific services, and accommodations and food service.

TABLE 10
Primary Industrial Exposure for OLDS Cases Reported in 2012

2002 North American Industry Classification System		#	%
11	Agriculture, Forestry, Fishing and Hunting	3	2
21	Mining	2	1
22	Utilities	0	—
23	Construction	6	3
31-33	Manufacturing	42	22
42	Wholesale Trade	1	<1
44-45	Retail Trade	9	5
48-49	Transportation and Warehousing	7	4
51	Information	0	--
52	Finance and Insurance	2	1
53	Real Estate and Rental and Leasing	2	1
54	Professional, Scientific, and Technical Services	11	6
55	Management of Companies and Enterprises	7	4
56	Administrative and Support and Waste Management and Remediation Services	4	2
61	Educational Services	3	2
62	Health Care and Social Assistance	20	10
71	Arts, Entertainment, and Recreation	8	4
72	Accommodation and Food Services	11	6
81	Other Services (except Public Administration)	10	5
92	Public Administration	14	7
00	Unknown	29	15
TOTAL		**191**	**100**

MIOSHA Inspections-Industrial Hygiene Results

The 191 individuals with OLDS worked at 180 different facilities. Inspections were performed at two 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 reported by a physician. The MIOSHA inspector conducted personal air monitoring on five individuals who performed surface grinding at the machine shop. Cobalt metal dust levels were all found to be below the MIOSHA Permissible Exposure Limit (PEL) for an 8-hour time-weighted average. Sampling was also conducted for oil mist (particulates not otherwise regulated), chromium and nickel, and these substances were also below MIOSHA PELs. Thirteen co-workers of the index case were interviewed for respiratory symptoms; one of the co-workers experienced daily or weekly shortness of breath, chest tightness or wheezing. A medical program was recommended for machine operators with potential exposure to tungsten carbide that contains cobalt.

The company was found to be in violation of several MIOSHA standards: (1) Recordkeeping— the company failed to maintain the MIOSHA-300 form for recording occupational injuries and illnesses; (2) Personal Protective Equipment— the company provided gloves, safety glasses with side shields and an optional dust mask but failed to certify their hazard assessment in writing; (3) Medical Services and First Aid— the company had an eye wash station but the unit did not contain water; (4) Hazard Communication — the company had not developed a written hazard communication program; (5) Respiratory Protection— several employees voluntarily wore a dust mask but were not provided basic advisory information on respirators as required by law.

The second inspection looked at cobalt exposures based on a case of hard metal lung disease reported by a hospital. The MIOSHA inspector conducted personal air monitoring on five individuals who performed surface grinding at the machine shop. Some of the machines were totally enclosed with exhaust ventilation and others were not enclosed and/or exhaust ventilated. Cobalt metal dust levels were all found to be below the limit of detection or below the MIOSHA Permissible Exposure Limit (PEL) for an 8-hour time-weighted average. Sampling was also conducted for tantalum, titanium and tungsten, and these substances were also below MIOSHA PELs or the limit of detection. The company was cited for violation of several MIOSHA standards: (1) Recordkeeping— the company failed to correctly maintain the MIOSHA-300 form for recording occupational injuries and illnesses; (2) Personal Protective Equipment— the company provided nitrile gloves and safety glasses but failed to train each employee required to wear this PPE; also, employees did not wear or use the appropriate PPE in Shipping and Receiving where a corrosive with a pH of 9.5 was used; (3) Medical Services and First Aid— an emergency eye wash station was not provided in Shipping and Receiving where a corrosive with a pH of 9.5 was used; (4) Hazard Communication — the company had not developed or fully implemented a written hazard communication program; (5) Respiratory Protection— an employee voluntarily wore a half face air purifying respirator but a respiratory protection program was not developed and implemented.

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.[10] 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 27 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 two in the 2000s. Overall, 92 (8.6%) silicosis cases worked for less than 10 years (data not shown). Ninety-seven (9.1%) of the 1,067 individuals with known decade of hire began work in the 1970s, 1980s, 1990s or 2000s; 28 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 24 people who first were exposed to silica since the 1980s, five worked in foundries, two were buffing and polishing metal, four 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, two worked in auto repair, 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.[11] 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 7.8 per 100,000 versus 1.4 per 100,000 for white workers (a 5.6-fold greater incidence).

The individuals reported generally have advanced disease: 268 (24.4%) with progressive massive fibrosis and another 390 (35.5%) with advanced simple silicosis (category 2 or 3). Approximately 67-84% 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-one 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.[12] Individuals with silicosis are at risk of developing pulmonary hypertension, clinically significant bronchitis and chronic obstructive pulmonary disease.[13]

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.[14] 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 other existing public health programs.[14]

Individuals with silicosis have an increased morbidity and mortality for both malignant and non-malignant respiratory disease.[1,15] 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 [4,16] as well as an increased risk of developing chronic renal disease, especially ANCA positive disease.[17,18,19]

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 all 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% 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% of the facilities, there is no way to monitor the adequacy of these controls in terms of health outcomes.

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.[12,15,20] These risks justify tighter work place controls for silica even if the number of new cases of silicosis continues to decline.

OSHA has proposed a new comprehensive standard for silica that includes a lower allowable level of silica in the air, worker education and medical surveillance. The standard is needed despite a decreasing trend of silicosis cases identified in Michigan, since this trend is more a product of other factors, not safer workplaces. The decrease in silicosis in Michigan can be attributed to the decrease in the number of foundry workers over time. There was a 75% decrease of foundry workers from 1973 to 1991 (Figure 6) and an 83% decrease in the number of reported cases of silicosis from 1993 to 2011, factoring in a 20-year latency period for the development of silicosis. Additionally, the number of abrasive blasting companies using silica decreased 71% from 1995 to 2011.

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. The proposed comprehensive silica standard is needed in the foundry industry as well as for newer exposures in construction and hydraulic fracturing. It is too soon to see any ill health effects of these newer silica exposure sources from hydraulic fracturing and highway reconstruction activities.

Asbestos-related disease, both malignant and non-malignant, is the single most commonly diagnosed occupational lung disease. Asbestos-related disease is tracked from a variety of reporting sources in Michigan, including hospital inpatient discharge data, the 3rd Judicial Circuit Court, B-Readers and other physicians, death certificates, and an annual survey of Michigan B-Readers. 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.

The second 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.

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