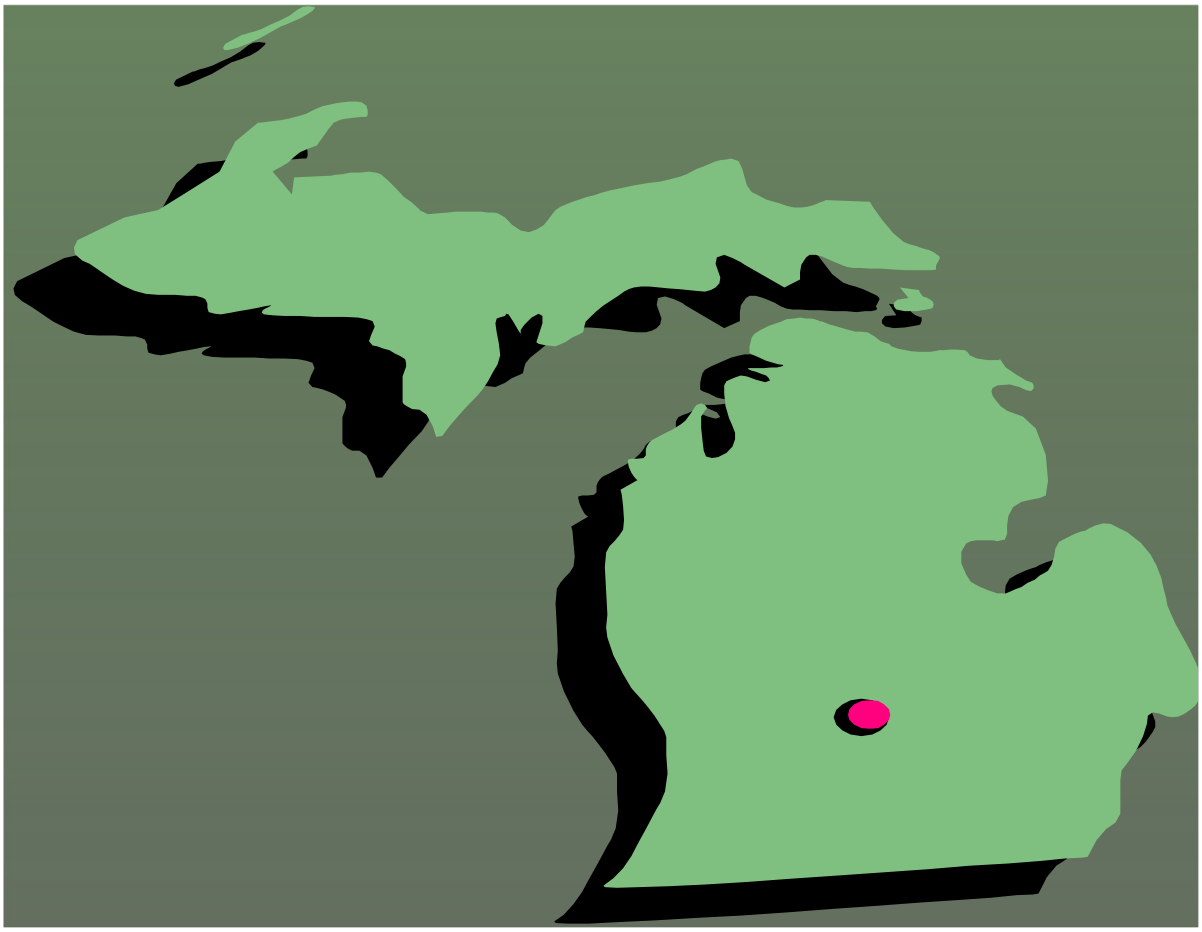
October 16, 2026

2024
ANNUAL REPORT

TRACKING SILICOSIS & OTHER WORK-RELATED LUNG DISEASES IN MICHIGAN



2024 ANNUAL REPORT TRACKING SILICOSIS & OTHER WORK-RELATED LUNG DISEASES IN MICHIGAN

Silicosis & Other Work-Related Lung Disease Surveillance Program

TABLE OF CONTENTS

SUMMARY	***1-2***
BACKGROUND	***2***
PROCEDURES	***2-3***
RESULTS	***3-22***
DISCUSSION	***22-25***
REFERENCES	***25-26***

Michigan State University Department of Medicine
909 Wilson Road, Room 117
West Fee Hall, East Lansing, MI 48824
517.353.1846
Kenneth D. Rosenman, MD
Mary Jo Reilly, MS

Michigan Department of Labor & Economic Opportunity (LEO)
PO Box 30643
Lansing, MI 48909
517.284.7777
Barton G. Pickelman
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

ED Emergency Department

LEO MI Department of Labor & Economic Opportunity

MIOSHA Michigan Occupational Safety & Health Administration

NAICS North American Industrial Classification System

NIOSH National Institute for Occupational Safety & Health

OLDs Other Work-Related Lung Diseases

PEL Permissible Exposure Limit



This report was funded by the National Institute for Occupational Safety & Health, under cooperative agreement U60-OH008466.

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 33rd annual report on silicosis in Michigan, and the 14th year of the expanded report to include surveillance data on the magnitude and nature of all 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, minor pneumoconiosis, and emerging work-related lung diseases. Work-related asthma has always been covered under a separate annual report (oem.msu.edu/index.php/annual-reports).



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].

♦ From 1985-2024, 1,227 silicosis cases have been identified through the Michigan tracking system.

♦ In 2024 only six new cases of silicosis were reported to LEO.

♦ Obstructive changes were found in two-thirds of the individuals with silicosis who had ever smoked cigarettes and among half of the individuals who had never smoked cigarettes.

♦ We estimate 67-139 adults in Michigan with silicosis were not reported in 2024.

♦ Medicare pays the health care costs for most patients with asbestosis.

♦ Acute irritative inhalations are the most common work-related lung disease reported in Michigan; in 2024 there were 189 cases reported as hospitalizations, treated in the emergency department or consulted with the Michigan Poison Center.

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 OLDs. This is a joint project of MIOSHA and Michigan State University, Department of Medicine, Division of Occupational and Environmental Medicine.

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

There are four main activities related to occupational lung disease surveillance in Michigan: identifying patients; interviewing patients and collecting relevant medical records; conducting workplace inspections; and sharing the overall results and lessons learned with industry, employees and other stakeholders.

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 Labor & Economic Opportunity *within 10 days of discovery*.

PATIENTS

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 IN MICHIGAN

♦ **Health Care Providers** Private practice, working for industry, NIOSH-certified "B" readers

♦ **Hospitals** International Classification of Disease 10th Revision (ICD-10) Silicosis (J62, J65), Hypersensitivity Pneumonitis (J67), Other Pneumoconiosis (J63, J64), Other Respiratory Conditions (J66, J68, Z57.2, Z57.3, Z57.5)

♦ **Workers' Disability Compensation Agency**

♦ **Michigan Poison 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

♦ **Emergency Medical Services (Ambulance)**

Once patients are identified, a letter is sent asking them to participate in a telephone interview. Afterwards, medical records are requested, including chest x-rays and pulmonary function test results.

CLASSIFICATION OF WORK-RELATED LUNG DISEASE

A physician who is board-certified in internal and occupational/environmental medicine and is also a NIOSH certified B-reader reviews medical evidence which may include an 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
2a) Chest x-ray interpretation with rounded opacities of 1/0 or greater profusion in the upper lobes.
or
2b) A biopsy report of lung tissue showing the characteristic silicotic nodule.

ASBESTOSIS

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

WORKPLACE INSPECTION

After the patient interview is completed, MIOSHA determines whether a workplace enforcement inspection will be conducted. During an inspection, co-workers are interviewed to determine if other individuals are experiencing similar breathing problems from exposure to the agent. Any workers reporting breathing problems are sent a letter advising them to see their doctor. Chest x-rays may be reviewed if the company performs periodic chest x-ray surveillance. Air monitoring for any suspected agent is conducted. The company's health and safety program and its Injury and Illness Log are 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. Brochures or other materials may be developed to address specific emergent issues identified.

Results

The following sections report results in this order: **silicosis** surveillance in Michigan from 1985-2024, **asbestos-related lung disease and mesothelioma**, and all other **OLDs** surveillance for calendar year 2024.

Table 1 shows that 1,227 people were confirmed with silicosis from 1985 - 2024. Figure 1 shows the number of confirmed silicosis cases by year, for 1985 – 2024. Figure 2 shows the overlap of reporting sources. Hospital discharge data is the most common source of reports.

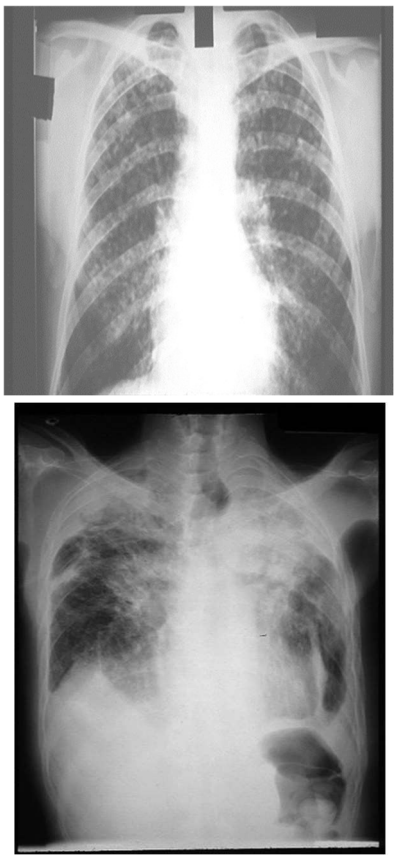
Figure 7 shows the number of individuals hospitalized in Michigan with silicosis from 1990 to 2024. Repeat admissions of the same individual within each calendar year are excluded from these counts of inpatient Hospital Discharge Data (HDC). For most patients, pneumoconiosis was not the primary discharge diagnosis listed on the hospital discharge record.

TABLE 1
Year and Reporting Source for 1,227 Confirmed Silicosis Cases: 1985-2024

Initial Reporting Source*

YEAR	PR	HDC	DC	WC	ICFU
85-87	0	67	35	42	0
1988	0	56	6	7	0
1989	7	40	9	4	3
1990	5	44	0	6	1
1991	5	37	1	6	0
1992	16	54	6	2	0
1993	6	31	1	4	0
1994	7	36	1	28	0
1995	26	35	3	2	0
1996	28	35	0	0	0
1997	13	48	1	0	0
1998	10	28	1	0	0
1999	5	25	1	1	0
2000	4	32	0	0	0
2001	8	11	1	0	0
2002	1	32	1	0	0
2003	8	26	0	0	0
2004	2	24	0	0	0
2005	4	26	0	0	0
2006	1	17	1	0	0
2007	2	19	0	1	0
2008	4	18	0	1	0
2009	1	12	1	0	0
2010	2	19	0	0	0
2011	0	11	0	0	0
2012	0	11	0	0	0
2013	0	17	1	0	0
2014	1	17	0	0	0
2015	2	11	0	0	0
2016	0	7	0	0	0
2017	1	4	0	0	0
2018	0	7	0	0	0
2019	0	6	0	0	0
2020	0	0	0	0	0
2021	0	3	0	0	0
2022	0	3	1	0	0
2023	0	4	0	0	0
2024	0	6	0	0	0
TOTAL	169	879	71	104	4

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



Top X-Ray shows Advanced Simple Silicosis.

Lower X-Ray shows Progressive Massive Fibrosis.

FIGURE 1
Confirmed Silicosis Cases by Year Reported: 1987-2024

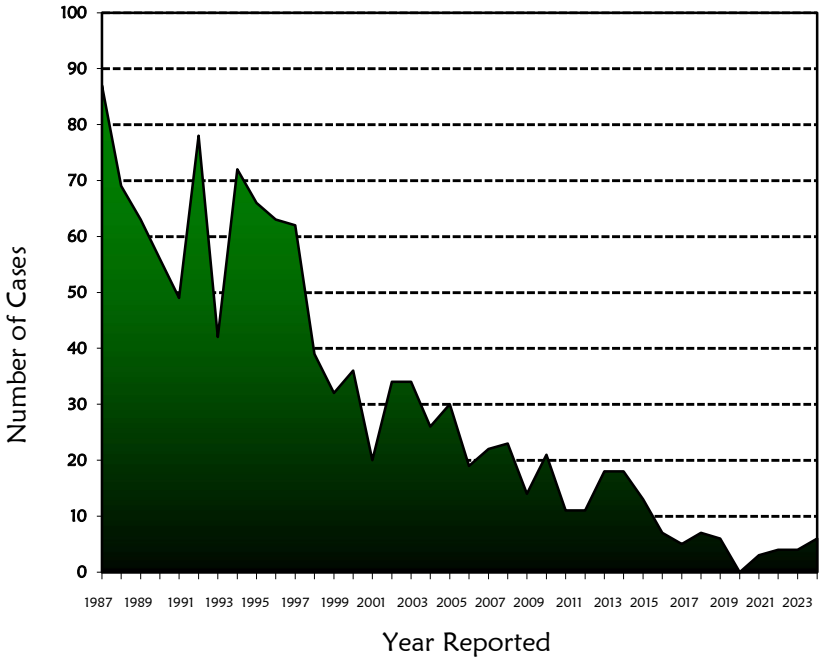
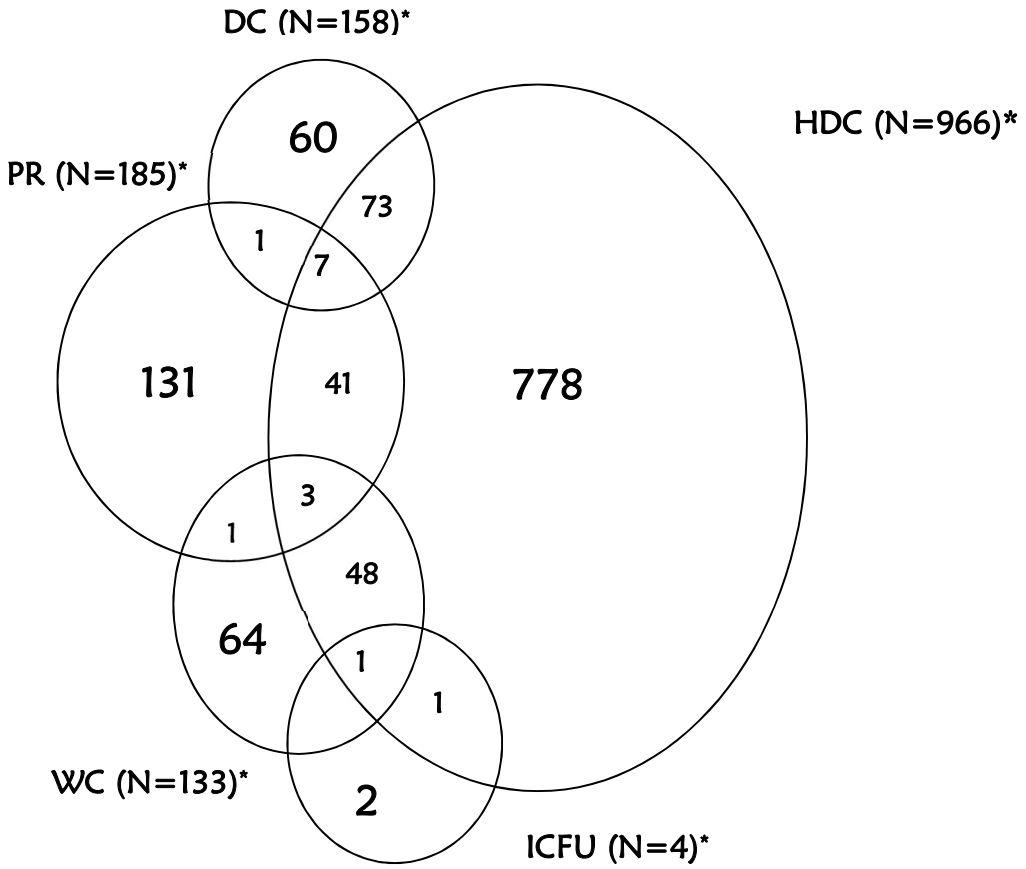


FIGURE 2
Overlap of Reporting Sources for 1,227 Confirmed Silicosis Patients: 1985-2024



*N's represent the total number reported at any time by 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 WC-DC for two individuals; and an overlap of HDC-DC-IFCU for one individual.

Based on capture-recapture analysis we estimate that although on average we receive 20 reports of silicosis a year, there are an additional 67-139 cases that are diagnosed each year but are not reported [2].

Demographics – Silicosis

SEX	RACE
Women 30 (2%)	White 727 (59%)
Men 1,197 (98%)	Black 454 (37%)
	Alaskan/American Indian 2 (<1%)
YEAR OF BIRTH	Asian 2 (<1%)
Range 1888-1996	Other 30 (2%)
Average 1925	Unknown 12 (1%)

AVERAGE ANNUAL INCIDENCE RATE

- Black
  5.9 per 100,000
- White
  1.2 per 100,000

The average annual incidence rate for Black workers is 4.9X greater than that of whites.

Numerator is the average number of silicosis cases by race for 1987-2022. Denominator Source: 2000 Census population data by race, age 40 and older.

Medical Results – Silicosis

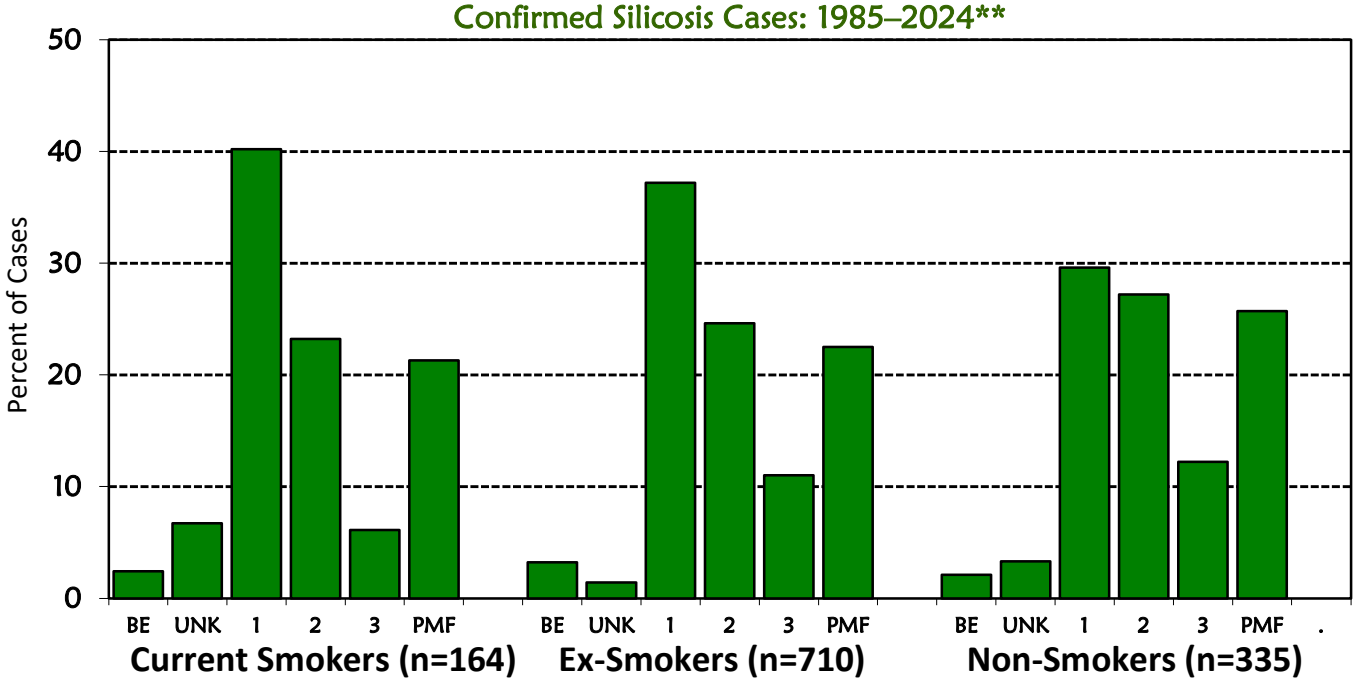
Overall, 874 (71.2%) of the 1,227 people with silicosis had simple silicosis and 284 (23.1%) had progressive massive fibrosis. Thirty-six (2.9%) individuals with silicosis had normal x-rays with lung biopsy evidence. Thirty-three (2.7%) individuals had x-ray reports which were consistent with silicosis, but the actual radiograph could not be obtained to classify.

Of the 1,227 people with silicosis, there were 1,209 who had a known cigarette smoking history, 335 (27.7%) never smoked cigarettes, 710 (58.7%) had quit, and 164 (13.6%) were still smoking. No information was available on 18 individuals. Figure 3 shows the distribution of x-ray results according to the International Labor Organization (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 60% 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. More comprehensive analyses of spirometry results were published in 2010 and 2018 [3,4].

Eight hundred forty of the silicosis cases had information on tuberculosis (TB) testing; 683 (81.3%) indicated they had ever had a skin test for TB; and 104 (15.2%) had a positive result. The percentage with a positive TB skin test did not change over time. One hundred sixty-nine (16.5%) of 1,024 individuals reported they had ever had active TB, regardless of whether a skin test had ever been done. In comparison, the annual percentage of subjects with active TB in the US from 1988 to 2016 was 0.003% – 0.010% and in Michigan from 2013 to 2017 was 0.001% [4].

FIGURE 3
Severity of X-Ray Results* by Smoking Status for Confirmed Silicosis Cases: 1985–2024**



*BE = Biopsy Evidence; UNK = Unknown; 1-3 = International Labor Organization categorization system for grading pneumoconiosis; 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: 1,209. Smoking status was unknown for 18 individuals.

TABLE 2 – Percent Predicted Forced Vital Capacity (FVC) by X-Ray Results and Cigarette Smoking Status for Confirmed Silicosis Cases: 1985-2024

	Percent Predicted FVC***					
	<60%		60-79%		>=80%	
X-Ray Results*	Ever Smoked	Never Smoked	Ever Smoked	Never Smoked	Ever Smoked	Never Smoked
	# (%)	# (%)	# (%)	# (%)	# (%)	# (%)
Biopsy Evidence	4 (19)	--	9 (43)	2 (50)	8 (38)	2 (50)
Unk Severity	6 (38)	2 (50)	6 (38)	1 (25)	4 (25)	1 (25)
Category 1	50 (23)	18 (30)	75 (35)	18 (30)	89 (42)	25 (41)
Category 2	40 (30)	22 (37)	49 (36)	19 (32)	46 (34)	19 (32)
Category 3	16 (34)	15 (63)	18 (38)	5 (21)	13 (28)	4 (17)
PMF	47 (38)	22 (39)	40 (33)	18 (32)	36 (29)	16 (29)
Total**	163 (29)	79 (38)	197 (35)	63 (30)	196 (35)	67 (32)

*Biopsy Evidence if no x-ray available; International Labor Organization categorization system for grading pneumoconiosis: 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: 765. Information was missing for 462 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: 1985-2024

	<=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	1 (5)	1 (33)	3 (14)	--	10 (48)	2 (67)	7 (33)	--
Unk Severity	1 (8)	--	1 (8)	--	3 (25)	3 (75)	7 (58)	1 (25)
Category 1	21 (10)	1 (2)	43 (20)	3 (5)	73 (35)	20 (33)	74 (35)	37 (61)
Category 2	5 (4)	3 (5)	27 (21)	8 (14)	52 (41)	16 (28)	43 (34)	31 (53)
Category 3	2 (4)	1 (4)	8 (18)	--	5 (11)	7 (30)	30 (67)	15 (65)
PMF	20 (17)	3 (6)	38 (32)	14 (26)	36 (30)	18 (33)	25 (21)	19 (35)
Total**	50 (9)	9 (4)	120 (22)	25 (12)	179 (33)	66 (33)	186 (35)	103 (51)

*Biopsy Evidence if no x-ray available; International Labor Organization categorization system for grading pneumoconiosis: 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: 738. Information was missing for 489 individuals.
***Percentages represent the proportion of individuals in each x-ray result category within smoking status category.



Location

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 Black silicosis cases were reported. The highest rates were among Black males in Shiawassee (220 cases per 100,000), Muskegon (101 cases per 100,000), Saginaw (31 cases per 100,000), and Monroe (16 cases per 100,000). The incidence of Black males with silicosis was 4.9 times greater than white males with silicosis. More information about health disparities and occupational lung disease can be found in our Fall 2014 PS News newsletter (V25N4), at: https://oem.msu.edu/images/newsletter/ProjectSensor/v25n4.pdf. Figure 4 shows the counties of the companies at which the patients' silica exposure occurred; Muskegon, Wayne and Saginaw were the top three counties for silicosis cases.

TABLE 4
Average Annual Incidence Rate of Silicosis
Among Michigan Workers by Race and County of Exposure: 1987-2024

	White* Males			Black** Males				White* Males				Black** Males		
County	County Pop'n	#	Rate	County Pop'n	#	Rate	**County**	County Pop'n	#	Rate	County Pop'n	#	Rate
Allegan	20850	2	0.3	275		—	Lake	2817	2	1.9	251		—
Alpena	7388	27	9.6	8		—	Lapeer	18176	2	0.3	226		—
Arenac	4168	1	0.6	62		—	Lenawee	20192	4	0.5	573		—
Baraga	1815	1	1.4	78		—	Livingston	32610	3	0.2	111		—
Barry	12360	4	0.9	34		—	Mackinac	2761	1	1.0	6		—
Bay	23674	8	0.9	226		—	**Macomb**	**156926**	**29**	**0.5**	**3233**	**7**	**5.7**
Benzie	3898	1	0.7	9		—	Manistee	5999	3	1.3	67		—
Berrien	**30479**	**9**	**0.8**	**3594**	**4**	**2.9**	Marquette	14199	18	3.3	224		—
Branch	9525	4	1.2	288		—	Mason	6683	1	0.4	41		—
Calhoun	**25345**	**29**	**3.0**	**2650**	**14**	**13.9**	Menominee	6054	12	5.2	2		—
Cass	10970	1	0.2	676		—	Midland	16605	3	0.5	128		—
Charlevoix	5942	3	1.3	5		—	**Monroe**	**29452**	**8**	**0.7**	**497**	**3**	**15.9**
Chippewa	7286	3	1.1	616		—	Montcalm	12433	4	0.8	335		—
Delta	9045	3	0.9	5		—	Montmorency	2957	1	0.9	3		—
Dickinson	6419	1	0.4	5		—	**Muskegon**	**30132**	**129**	**11.3**	**3564**	**137**	**101.2**
Eaton	20377	3	0.4	781		—	**Oakland**	**216359**	**18**	**0.2**	**20085**	**7**	**0.9**
Emmet	6861	1	0.4	24		—	Ontonagon	2295	2	2.3	1		—
Genesee	**69596**	**13**	**0.5**	**13423**	**6**	**1.2**	**Ottawa**	**41916**	**4**	**0.3**	**270**	**1**	**9.7**
Gladwin	6615	1	0.4	8		—	Roscommon	7325	1	0.4	9		
Gogebic	4353	3	1.8	22		—	**Saginaw**	**36097**	**66**	**4.8**	**5936**	**70**	**31.0**
Gd Traverse	16451	1	0.2	57		—	**St. Clair**	**33209**	**6**	**0.5**	**623**	**1**	**4.2**
Gratiot	8356	2	0.6	371		—	**St. Joseph**	**12266**	**4**	**0.9**	**251**	**1**	**10.5**
Hillsdale	9857	9	2.4	36		—	Sanilac	9753	3	0.8	23		—
Ingham	41166	12	0.8	3987		—	Schoolcraft	2121	1	1.2	18		—
Iosco	7280	1	0.4	30		—	**Shiawassee**	**14737**	**4**	**0.7**	**26**	**2**	**202.4**
Iron	3531	3	2.2	28		—	Tuscola	12334	1	0.2	108		—
Isabella	9294	1	0.3	77		—	Van Buren	15129	2	0.3	808		—
Jackson	**31380**	**3**	**0.3**	**2685**	**2**	**2.0**	Washtenaw	47535	8	0.4	5758		—
Kalamazoo	39985	5	0.3	3004		—	**Wayne**	**236472**	**141**	**1.6**	**134974**	**170**	**3.3**
Kent	**93136**	**16**	**0.5**	**6768**	**3**	**1.2**	Wexford	6478	4	1.6	6		—
Keweenaw	639	1	4.1	1		—							

*Rate per 100,000 among white men age 40+. Numerator: average number of white males with silicosis for the years 1987 – 2024; denominator: 2000 Census population data for white men age 40 and older, by county. In 2000, there were 1,730,017 white males 40 years and older living in Michigan.

**Rate per 100,000 among Black men age 40+. Numerator: average number of Black males with silicosis for the years 1987 – 2024; denominator: 2000 Census population data for Black men age 40 and older, by county. In 2000, there were 219,076 Black males 40 years and older living in Michigan.

Type of Industry – Silicosis

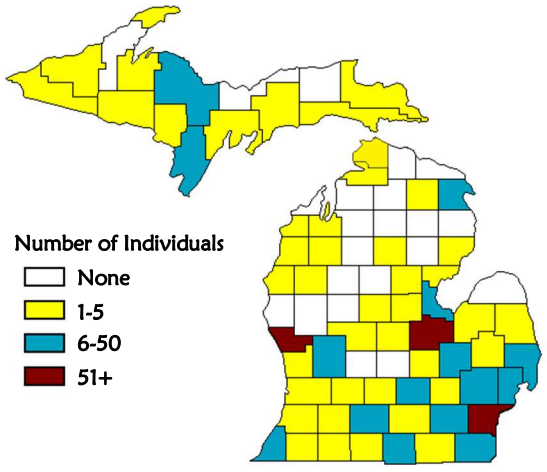
Table 5 shows the Michigan industries by NAICS codes, where exposure to silica occurred from 1985 to 2024. The predominant industries were in manufacturing (84%), construction (9%) and mining (4%). Most of the manufacturing jobs were in iron foundries. Exposure to silica is still occurring in foundries (Figures 5 and 6).

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 for the confirmed silicosis patients in a silica-using job is 1951, ranging from 1910 to 2018. Six individuals with silicosis began working in the 2000s, 10 began working in the 1990s, 27 in the 1980s, 91 in the 1970s and 187 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: 1985-2024

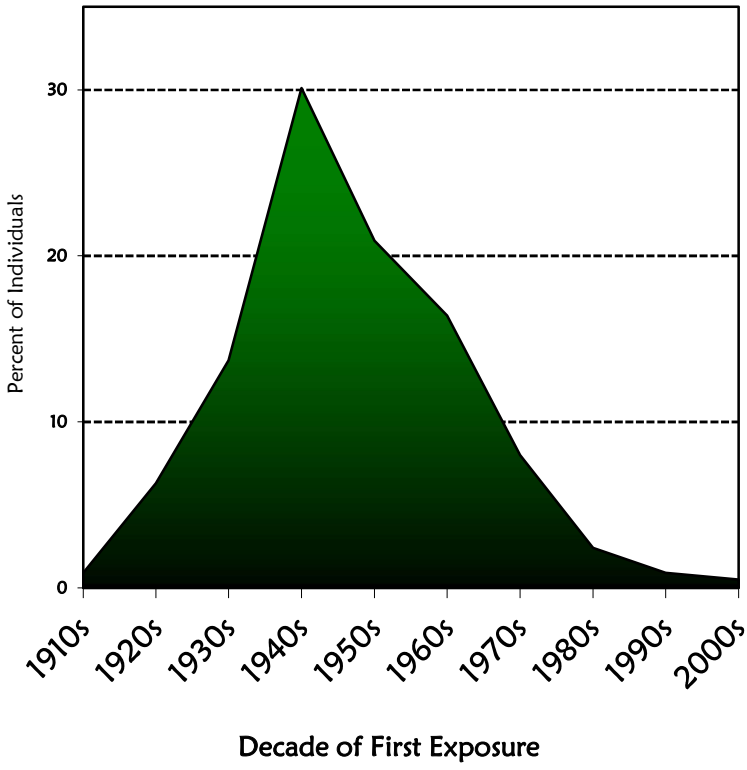
	INDUSTRY (2002 NAICS)	#	%
11	Agriculture, Forestry, Fishing, & Hunting	2	0.2
21	Mining	54	4.4
22	Utilities	1	0.1
23	Construction	113	9.2
31-33	Manufacturing	1,025	83.5
42	Wholesale Trade	2	0.2
44-45	Retail Trade	3	0.2
48-49	Transportation & Warehousing	7	0.6
56	Administrative & Support & Waste Management	1	0.1
62, 81	Health Care & Social Assistance	7	0.6
92	Public Administration	4	0.3
00	Unknown	8	0.7
Total		1,227	

FIGURE 4
Distribution of Confirmed Silicosis Cases by County of Exposure: 1985-2024



*Seventy-seven individuals were exposed to silica out-of-state, and 33 individuals had an unknown county of exposure.

FIGURE 5
Distribution of Decade when Silica Exposure Began for Confirmed Silicosis Cases: 1985-2024*



*Decade of first exposure was unknown for 87 individuals with silicosis.

Industrial Hygiene Results – Silicosis

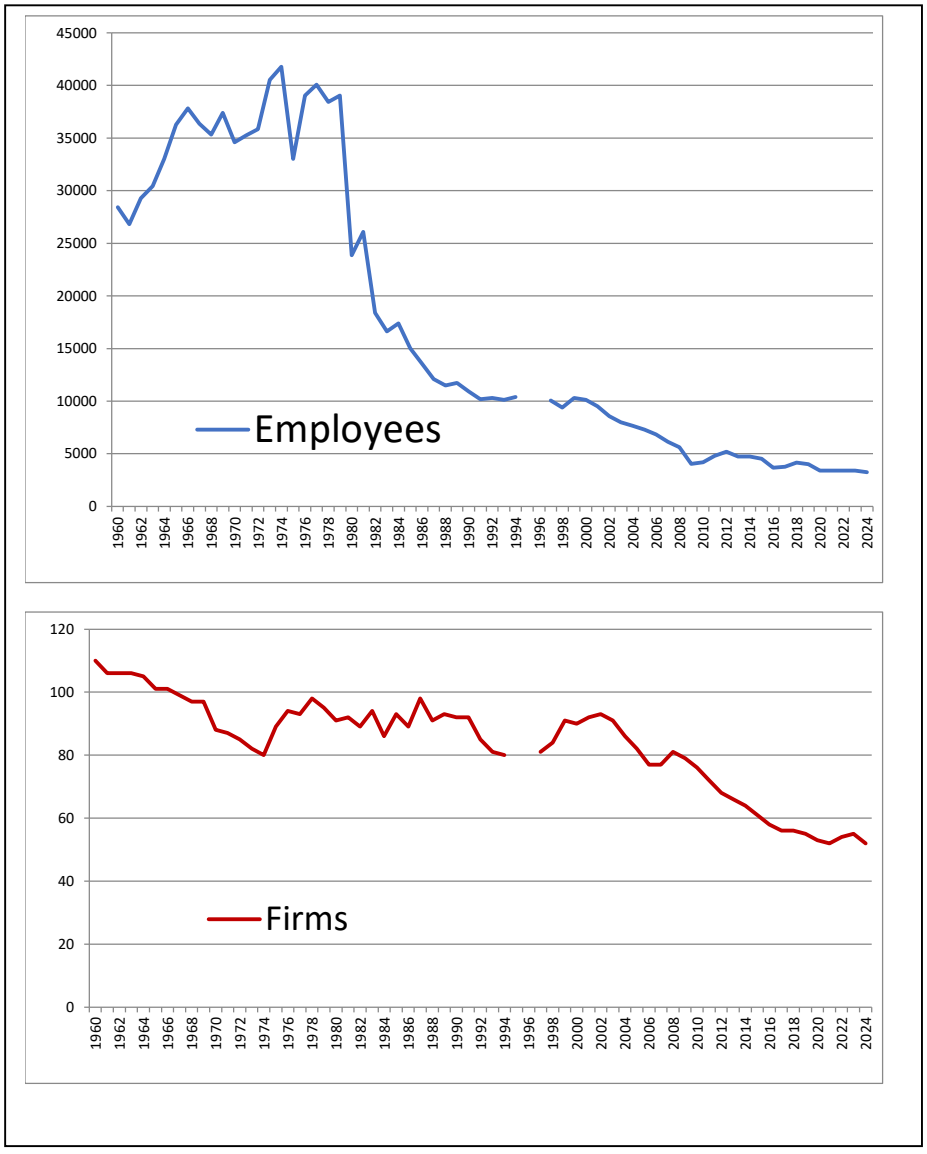
One thousand two hundred twenty-seven individuals were exposed to silica in 520 facilities (Table 6). There were no silica-related inspections conducted from 2020 through 2024 based on these individuals. Since 1988, inspections were performed by MIOSHA at 93 (18.1%) of the 514 facilities associated with silicosis cases. One hundred sixty-one (31.3%) facilities were no longer in operation, 70 (13.6%) were located out of state, 29 (5.6%) facilities no longer used silica, 79 (15.4%) workplaces were in the construction industry, nine (1.8%) were covered by the Mine Safety and Health Administration jurisdiction, and for 73 (14.2%), the specific location where the silica exposure occurred was unknown.

Air sampling for silica was conducted in 66 of the 93 facilities inspected (Table 7). MIOSHA adopted a new enforceable permissible exposure limit (PEL) of 50 µg/m³, on June 23, 2018. This new PEL is the same as the NIOSH recommended exposure level (REL). The previous MIOSHA PEL was 100 µg/m³. Forty of 66 (60.6%) facilities were above 50 µg/m³. In 2007, MIOSHA inspected all 47 silica-using foundries in the state. Personal air monitoring for silica was conducted in 43 of the 47 facilities; 15 (35%) were above the PEL. From 2017 to August 2019, ten (22%) of 45 inspections at foundries, construction sites and a few other companies that use silica had at least one respirable silica sample above the PEL.

Twenty-three of the 66 (34.8%) were above 100 µg/m³ for silica. The three (4.5%) most recent inspections were above 50 µg/m³. Another two (3.0%) companies were above the MIOSHA standard for beryllium and one company was above the MIOSHA standard for silica and silver.

Prior to the 2018 silica standard requiring employers to provide a medical monitoring program, only eight of the 74 (10.8%) 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 certified B-reader. Three (4.1%) companies provided periodic chest x-rays that were not interpreted by a certified B-reader. Twenty-two (29.7%) only performed pre-employment testing, 29 (39.2%) provided no medical surveillance, and 18 (24.3%) performed annual or biennial pulmonary function testing without chest x-rays. There has been no evaluation of the performance of medical surveillance after it became a requirement.

FIGURE 6
Michigan Ferrous Foundries 1960-2024:
Number of Employees and Number of Firms



Source: www.bls.gov data extract from Quarterly Census of Employment and Wages, Michigan, NAICS 33151 Ferrous Metal Foundries, Private ownership, all establishment sizes, last accessed 10-2-2026. Data was unavailable for 1995 and 1996.

TABLE 6
Status of Facilities Where 1,227 Confirmed Silicosis Cases were Exposed to Silica: 1985-2024

	Cases	Facilities	
Inspection Status	#	#	%
Inspection Completed	497	93	17.9
Scheduled for Inspection	0	0	--
MSHA* Jurisdiction	23	9	1.7
Facility Out-of-Business	438	161	31.0
Facility Out-of-State	78	71	13.7
Facility No Longer Uses Silica	34	29	5.6
Building Trade: No Inspection	81	81	15.6
Unknown	76	76	14.6
Total	1,227	520**	

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

TABLE 7
MIOSHA Inspections of 93 Facilities of Silicosis Cases Exposed to Silica: 1985-2024

	Companies	
	#	%
Air Sampling Performed	**66**	
Above NIOSH* Rec Std for Silica	40	60.6
Above MIOSHA Enforceable Std for Silica	26	39.4
Medical Surveillance Evaluated	**74**	
Periodic Chest X-Rays with a B-reader	8	10.8
Periodic Chest X-Rays without a B-reader	3	4.1
Pre-employment Testing Only	22	29.7
No Medical Surveillance	29	39.2
Periodic Pulmonary Function Testing	18	24.3

*NIOSH National Institute for Occupational Safety & Health.

Sandblasting – Silicosis

Nine hundred ten of the 1,227 individuals had known sandblasting history; 333 (36.6%) stated they had done sandblasting as part of their work.

Silica Standard

An updated silica standard was promulgated in Michigan on February 22, 2017:

Key Provisions of the updated OSHA Silica standard
https://www.michigan.gov/leo/bureaus-agencies/miosha/topics/silica

- Reduces the PEL for respirable crystalline silica to 50 micrograms per cubic meter of air, averaged over an 8-hour shift.
- Requires employers to: use engineering controls (such as water or ventilation) to limit worker exposure to the PEL; provide respirators when engineering controls cannot adequately limit exposure; limit worker access to high exposure areas; develop a written exposure control plan, offer medical exams to highly exposed workers, and train workers on silica risks and how to limit exposures.
- Employers are required to offer medical examinations to employees exposed above the PEL for 30 or more days a year and provide them information about their lung health.

Content of Medical Examination - Appendix B – Medical Surveillance Guidelines
https://www.osha.gov/sites/default/files/AppendixBtosect1926.1153.pdf

- Medical and work history, with emphasis on: past, present, and anticipated exposure to respirable crystalline silica, dust, and other agents affecting the respiratory system; any history of respiratory system dysfunction, including signs and symptoms of respiratory disease (e.g., shortness of breath, cough, wheezing); history of TB; and smoking status and history.
- Physical examination, with special emphasis on the respiratory system - Initial examination and every three years.
- TB testing - Initial examination.

Brief history of six individuals first exposed to silica in the 2000s

Case 1. A male in his 50s worked one year at a company that made sandpaper. He never performed sandblasting. He formerly smoked cigarettes from his teens to his mid-50s. He had advanced simple silicosis per x-ray ILO B-reader classification. He died in his 60s.

Case 2. A male in his 50s worked two years sandblasting metal parts. He was a lifelong non-smoker. He had progressive massive fibrosis (PMF) per x-ray ILO B-reader classification. He died in his 60s.

Case 3. A male in his 60s worked 13 years as a grinder at a foundry. He also performed sandblasting. He was a lifelong non-smoker. He had PMF per x-ray ILO B-reader classification.

Case 4. A male in his 60s worked 14 years as a sandblaster in construction. He was a lifelong non-smoker. He had advanced simple silicosis per x-ray ILO B-reader classification.

Case 5. A male in his 40s worked less than 10 years performing knockout at a foundry. He smoked a half pack of cigarettes a day from his mid-20s to his mid-30s. He had advanced simple silicosis per x-ray ILO B-reader classification.

Case 6. A male in his 60s worked 32 years as an owner/operator of a sandblasting business. He never smoked. He was also exposed to asbestos. He had progressive massive fibrosis (PMF) per x-ray ILO B-reader classification.

- Spirometry - Initial examination and every three years. Must be administered by a spirometry technician with a current certificate from a NIOSH approved course.
- PA radiograph of the chest at full inspiration - Initial examination and every three years. Must be interpreted and classified according to the ILO International Classification of Radiographs by a NIOSH-certified B Reader.
- Additional testing the provider deems appropriate.

Requirements on Reporting Results of Medical Examination

Written medical report to employee within 30 days must include:

- The results of the medical examination, including any medical condition(s) that would place the employee at increased risk of material impairment to health from exposure to respirable crystalline silica and any medical conditions that require further evaluation or treatment;
- Any recommended limitations upon the use of a respirator;
- Any recommended limitations on exposure to respirable crystalline silica;
- A statement that the employee should be examined by a Board Certified Specialist in Pulmonary Disease or Occupational Medicine, where the B reading is 1/0 or higher for rounded opacities or where the physician or other licensed health care professional (PLHCP) has determined such a referral is necessary.

Written medical report to employer within 30 days must include:

- Date of the examination;
- A statement that the examination has met the requirements of this section; and
- Any recommended limitations on the employee's use of a respirator.



Asbestos-Related Lung Disease and Mesothelioma

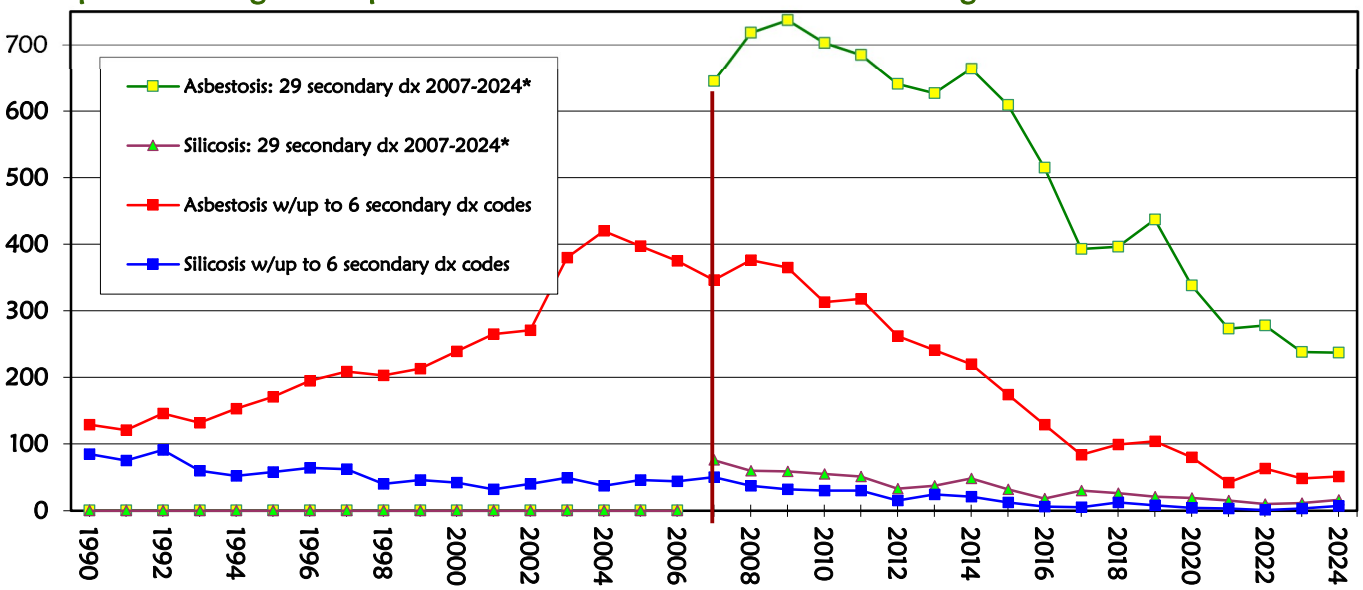
The following section reports the results of **asbestos-related lung disease and mesothelioma**. Figure 7 shows the number of individuals hospitalized in Michigan with asbestosis from 1990 to 2024. Repeat admissions of the same individual within each calendar year are excluded from these counts of inpatient Hospital Discharge Data (HDC). For most patients, pneumoconiosis was not the primary discharge diagnosis listed on the discharge record. From 1993 to 2006, there was a steady increase in the number of hospitalizations for asbestosis; from 2007-2016 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). There was a slight decrease in the number of asbestosis-related hospitalizations in 2020 and 2021, a slight increase in 2022, and a decrease in 2023 and 2024. The red line in Figure 7 for 2007 - 2024 shows that the number of asbestosis cases with up to six diagnostic codes was markedly less compared to the green line with 29 diagnostic codes.

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 Medicare data published by NIOSH through 2019 [5].

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 Workers' Compensation (WC) insurance [1,6]. 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 - 2024

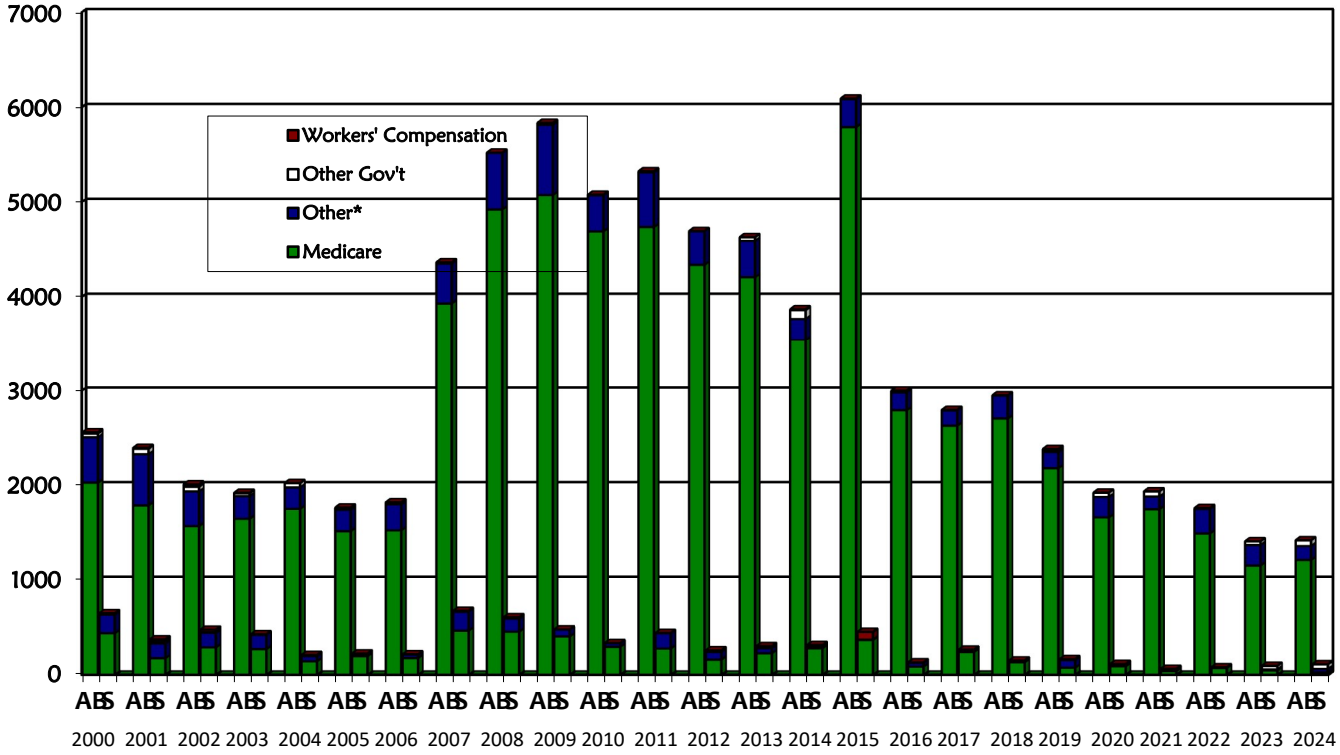


In addition to identifying asbestos-related disease from HDC inpatient data, occupational disease reports submitted to LEO constitute another source of reports. In fact, asbestos-related lung disease is the most common dust disease reported to LEO (Figure 9), through individual physicians certified as B-Readers, death certificates and the Michigan 3rd Judicial Court. In 2024, for example, 188 cases of asbestos-related lung disease were identified through B Readers, death certificates or the 3rd Judicial Court (Figure 9). 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 LEO (Figure 9 and Table 8); these sources may or may not overlap as they each represent a different way to obtain a count of asbestos-related disease (reports to LEO and reports from HDC data).

B-READER SURVEY

In 1995, there were 16 B-Readers in Michigan. Since 2010, there have been 5-7 physicians in Michigan who were certified and active 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 23 (1.4%) of 1,590 x-rays reviewed in calendar year 2022, to a high of 3,640 (34%) of 10,575 x-rays reviewed in calendar year 1999. In 2024, 3.5% of 2,922 x-rays reviewed showed evidence of work-related asbestos-related disease. The overall downward change in percentages over time may represent a decreased incidence of radiographic changes and/or a change in the source of reports (more radiographs being interpreted from current rather than retired workers), although 2023 showed an increase in the incidence of radiographic changes; there were also two additional B-Readers reporting in 2023 compared to 2022. In 2024 there was a decrease in the percentage of x-rays showing evidence of occupational disease. Table 8 is based on an annual survey completed by the B-Readers in Michigan.

FIGURE 8
Days Hospitalized by Payment Source at Discharge for Asbestosis & Silicosis in Michigan: 2000-2006 & 2007-2024



*Other includes Medicaid, HMOs, PPOs, Other Insurance, Self-Pay and No Charge Payment Sources. AB= Asbestos, S=Silicosis.

FIGURE 9
Asbestos-Related Cases Reported from B-Readers, Death Certificates and the 3rd Judicial Court: 1989-2024

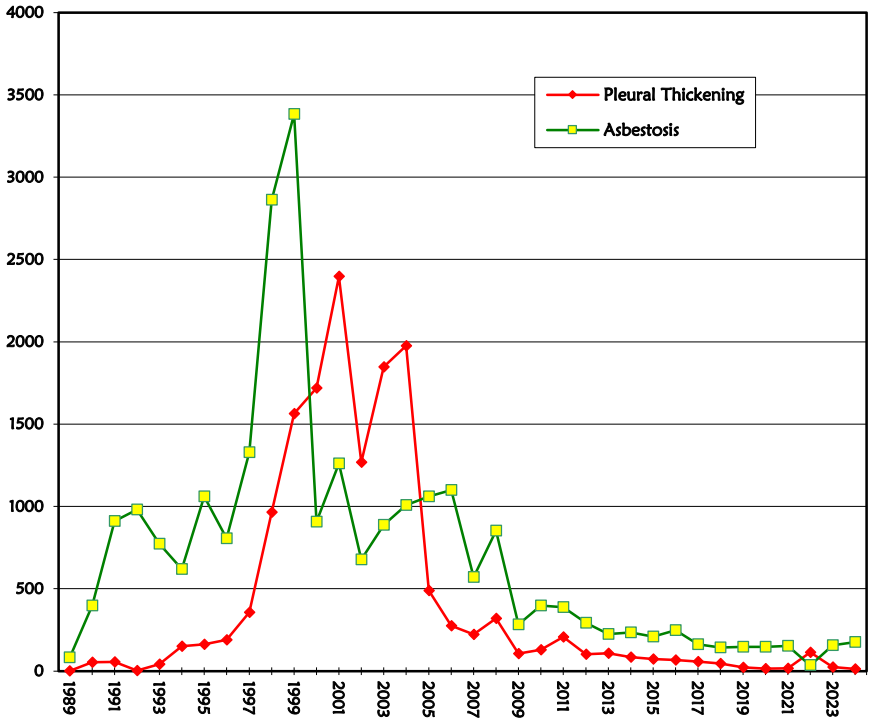


TABLE 8 Results of Annual Survey* of B-Readers in Michigan: 1995-2024

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
2013	6	130	46	176	2,802	6
2014	6	127	56	183	3,765	5
2015	6	67	43	110	3,572	3
2016	5	112	39	151	2,247	7
2017	5	75	28	103	2,600	4
2018	5	65	31	96	3,841	3
2019	6 (5 active)	70	24	94	2,034	5
2020	6 (5 active)	21	14	35	1,184	3
2021	6 (5 active)	36	29	65	2,362	3
2022	5	5	18	23	1,590	1.4
2023	7	49	20	69	1,922	3.5
2024	7	47	20	67	2,922	2.3

*Actual chest radiograph interpretations were not submitted with the surveys.
**There was no survey in 2004.

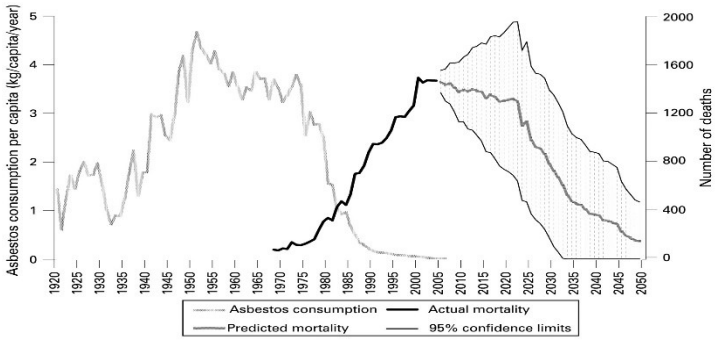
Mesothelioma

Mesothelioma is a rare condition, strongly associated with asbestos exposure. The association between exposure to asbestos and the risk of developing mesothelioma was first reported in the medical literature in 1943 [7]. Mesothelioma is almost always caused by exposure to asbestos [8]. Sometimes the exposure has occurred indirectly; handling/washing the clothes of someone who works with asbestos or being a bystander at a location where asbestos was applied or disturbed by another worker. In one study, 81% of 759 cases of mesothelioma in Australia where no asbestos exposure was identified by history, had elevated levels of asbestos in their lung tissue [9]. 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 [10]. Among cohorts of asbestos-exposed workers, up to 10% of deaths have been attributed to mesothelioma. Lung cancer is the most common cancer among asbestos exposed workers. Unlike lung cancer, there is no additional risk of mesothelioma among current or ex-cigarette smokers.

The use of asbestos in the United States peaked in the 1950s (Figure 10). Given that mesothelioma typically occurs

30-40 years after first exposure to asbestos, one would expect the number of cases of mesothelioma in the U.S. to be peaking now, approximately 40 years after the 1980s when asbestos use began to markedly decrease. However, there are large amounts of asbestos still in place from past use as insulation and in products such as asbestos cement, floor tiles and outdoor siding that can cause more recent exposure during renovation or demolition operations. Mortality from asbestos shows how the long latency period of adverse health effects from asbestos causes disease long after its use has decreased (Figure 10).

FIGURE 10
US Asbestos Consumption per Capita (1920-2006), Actual (1968-2004) and Projected (2005-2049) Deaths from Asbestos



The Michigan Cancer Registry collects data on the demographics of mesothelioma in Michigan. The number of patients with mesothelioma by year in Michigan from 1985-2023 is shown in Figure 11. In 2023, the most recent year with data compiled, there were 88 new cases (66 men and 22 women), up from 59 men and 16 women in 2022. The age range in 2023 was 32-92 years, with an average age of 73. The peak year was in 2000, with 136 new cases. The number of new cases per year ranged from 92-130 in subsequent years.

Approximately 25% of the individuals with mesothelioma were women. In 2023, of the 88 cases, 93% were white, 6% were Black and 1% were Filipino.

Figure 12 shows the age at diagnosis separately for men and women. Consistent with latency from first exposure to asbestos, the number of mesothelioma cases increased with age. The peak age of occurrence of mesothelioma was for individuals 65 years and older for men and women.

FIGURE 11
Number of Men and Women in Michigan Diagnosed with Mesothelioma: 1985-2023

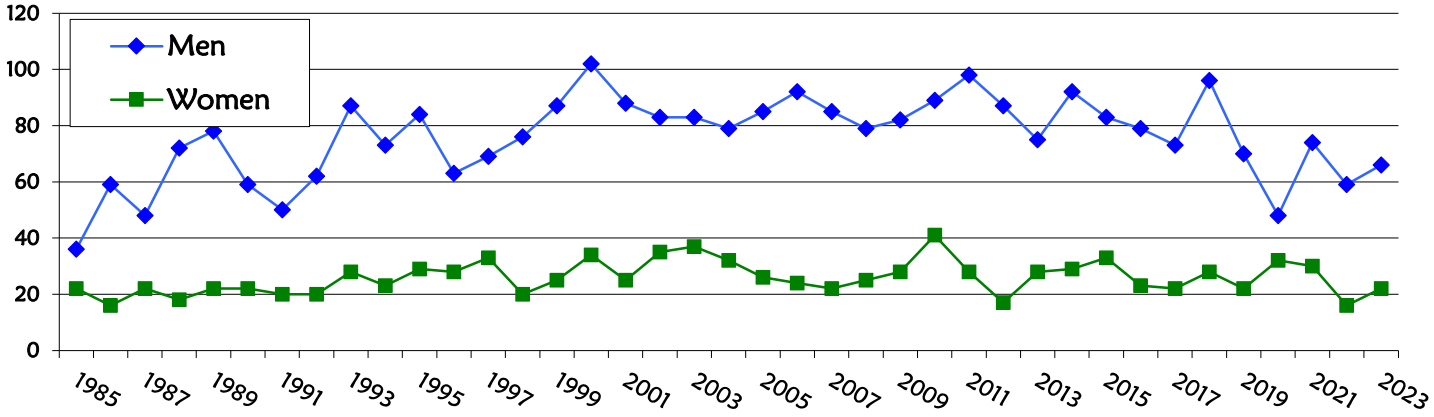
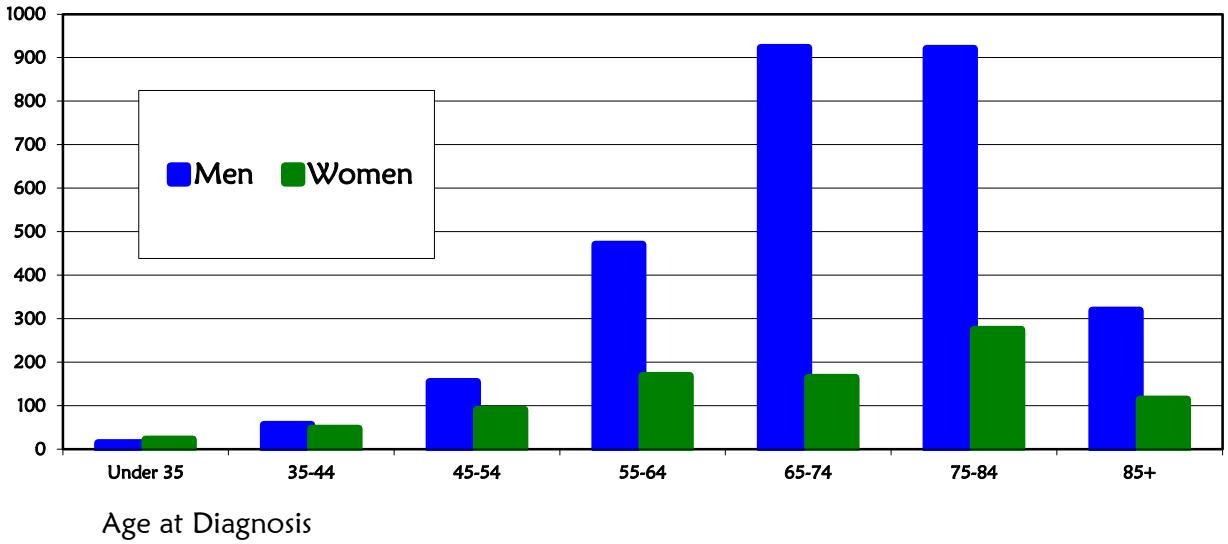


FIGURE 12
Cases of Mesothelioma in Michigan by Gender
and Age at Diagnosis: 1985-2023



There were 4-5 times more men than women with mesothelioma, reflecting the likelihood of more men than women working in an occupation/industry with asbestos exposure. Table 9 shows the distribution of industry and occupation for deceased men and women with mesothelioma in the Michigan Tumor Registry, based on death certificate data from 2016-2024. Construction, shipbuilding, and certain industrial facilities where asbestos insulation was used on piping, reaction kettles, furnaces and to make asbestos-containing products were the most frequently reported industries on death certificates. Given that the information on occupation and industry comes from death certificates from the Michigan Division for Vital Records and Health Statistics, the occupation and industry reported is the person's usual occupation and industry and may differ from what they did 30-40 years prior to their diagnosis and death when they were exposed to asbestos. Coastal states, which had a large shipbuilding and repairing industry generally have the highest incidence of mesothelioma, while the incidence in industrial states like Michigan have the next highest rates [11,12].

Mesothelioma Encasing Lung
on Autopsy Specimen

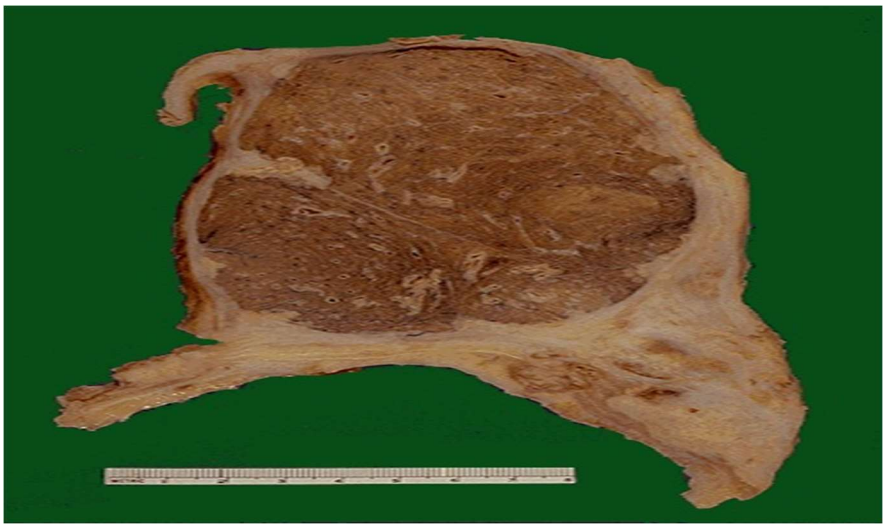


Table 9
Industry and Occupation of Deceased Mesothelioma Patients in the Michigan Tumor Registry, Michigan, 2016-2024

INDUSTRY (men/women) Occupation	#	%
AGRICULTURE (5/1)	6	1.5
Farmer (6)		
MINING (3/0)	3	0.7
Engineer (1), Miner (1), Safety & Compliance (1)		
UTILITIES (7/1)	8	1.9
Engineer (2), Janitor (2), Utility worker (4)		
CONSTRUCTION (66/1)	67	16.3
Carpenter (9), Electrician (5), Engineer (2), General laborer (32), Office worker (1), Plumber/pipefitter (8), Supervisor (9), Welder (1)		
MANUFACTURING (136/11)	147	35.7
Engineer (19), Factory worker (55), Janitor (2), Professional/office (24), Skilled trades (36), Supervisor (5), Transportation/driver (6)		
WHOLESALE TRADE (1/0)	1	<0.1
Delivery driver (1)		
RETAIL TRADE (15/2)	17	4.1
Professional/office (6), Retail trade worker (10), Service manager (1)		
TRANSPORTATION & WAREHOUSING (22/0)	22	5.3
Engineer (1), Professional/office (3), Skilled Trades (1), Transportation worker (5), Truck driver (10), Water transport worker (2)		
INFORMATION (4/3)	7	1.7
Professional/office (5), Technician (2)		
FINANCE (4/4)	8	1.9
Professional/office (8)		
REAL ESTATE & RENTAL & LEASING (1/0)	1	<0.1
Realtor (1)		
PROFESSIONAL, SCIENTIFIC & TECHNICAL SERVICES (4/7)	11	2.7
Engineer (3), Land surveyor (1), Professional/office (7)		
ADMINISTRATIVE & SUPPORT & WASTE MGT SERVICES (2/1)	3	0.7
Grounds maintenance (2), Office worker (1)		
EDUCATIONAL SERVICES (10/11)	21	5.1
Administration (2), Janitor (3), Teacher (16)		
HEALTH CARE & SOCIAL ASSISTANCE (6/22)	28	6.8
Health care worker (10), Janitor (2), Nurse/aid (9), Professional/office (7)		
ARTS, ENTERTAINMENT & RECREATION (2/2)	4	1.0
Artist (3), Coach (1)		
ACCOMMODATION & FOOD SERVICES (3/5)	8	1.9
Food service worker (3), Housekeeper (1), Professional/office (2), Supervisor (1), Waitress (1)		
OTHER SERVICES (7/1)	8	1.9
Cosmetologist (1), Janitor (1), Mechanic (3), Minister (2), Pesticide Applicator (1)		
PUBLIC ADMINISTRATION (22/2)	24	5.8
Judge (1), Mail carrier (2), Maintenance (3), Professional/office (8), Public safety (10)		
HOMEMAKER (0/11)	11	2.7
SELF-EMPLOYED (1/0)	1	<0.1
UNKNOWN (1/0)	1	<0.1
NOT EMPLOYED (1/4)	5	1.2
Total	412	

Figure 13 shows the distribution of the number of cases of mesothelioma among Michigan residents by county. The southeast and central region of Michigan has the highest number of cases of mesothelioma. Increased cases of mesothelioma in Marquette County in the Upper Peninsula are thought to be from asbestos exposure on equipment used in paper mills, and mining operations where asbestos was a contaminant during ore mining as well as exposure from asbestos insulation during ore processing. Increased cases in Bay and Saginaw counties are thought to be from asbestos exposure used in the largest shipyard that was in Michigan, and foundries in Saginaw County. In Muskegon and Kent counties as well as the Detroit metropolitan area, asbestos exposure occurred within the numerous industrial facilities located in these regions. There was a total of 2,277 cases from 2004-2023. Figure 14 shows the average annual incidence rates of mesothelioma among Michigan residents by county. The counties with the highest rates are Marquette (2.8 per 100,000); Midland and Bay (each with 2.4 per 100,000); St. Clair (2.1 per 100,000) and Muskegon (2.0 per 100,000). The annual average mesothelioma incidence rate for 2004-2023 in Michigan was 1.3 cases per 100,000.

Mesothelioma has a poor prognosis. Data from the 18 cancer registries in the CDC Surveillance, Epidemiology, and End Results Program (SEER) reported 91.4% mortality with a median of seven months from diagnosis [13]. The best treatment results are found for patients receiving multimodality therapy, usually consisting of neoadjuvant chemotherapy, followed by surgery and adjuvant radiotherapy. Combining these modalities, a median survival of 17-38 months for patients with tumor Stage I, to 7-24 months for patients with tumor Stage IV has been reported [14]. One aspect of mesothelioma management that can be overlooked by physicians is the availability of compensation to cover medical care and funeral costs and support of family dependents. Patients with mesothelioma and their dependents should be encouraged to seek legal advice regarding the potential to receive compensation.

FIGURE 13
Distribution of MI Residents Diagnosed with Mesothelioma by County: 2004-2023

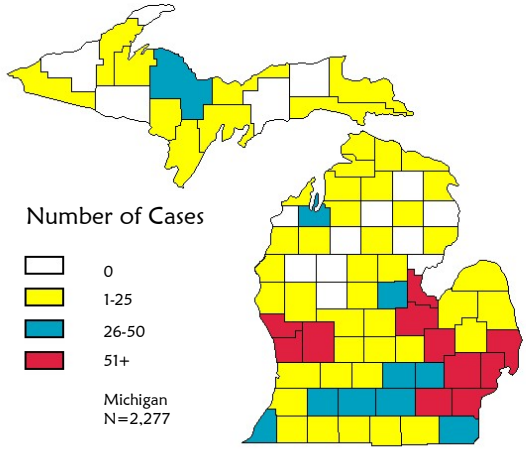
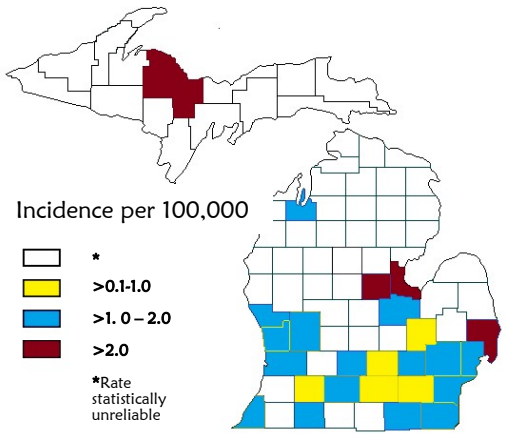


FIGURE 14
Age-Adjusted Incidence Rates of Mesothelioma among MI Residents, by County: 2004-2023



Other Work-Related Lung Diseases (OLDs)

2011 was the first year of data collection for other work-related 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 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 pneumoconiosis such as hard metal lung disease and coal workers' pneumoconiosis. A physician

board-certified in internal and occupational 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.

Table 10 shows the distribution of diseases reported by year, from 2019-2024. 2011-2018 data can be found in prior annual reports. Over all the years, chemical irritation/irritative bronchitis and chemical pneumonitis were the most common conditions.

Each year varies slightly in the types of conditions reported, in part related to the reporting sources within a given year. In 2011 and 2012, hospitals and Workers' Compensation reported 72% of the 139 cases, and 68% of the 191 cases, respectively. In 2013 and 2014, the Michigan Poison Center (MPC) and hospitals reported 69% of the 162 cases, and 63% of the 150 cases, respectively. In 2015, hospitals reported 59% of the 167 cases, followed by Workers' Compensation reporting 16% of the cases (Table 11). In 2016 through 2024 the MPC and hospitals, respectively, reported the greatest percentages of cases.

The following statistics are based on the 264 cases of other lung diseases confirmed from 2024.

Similar to delays in reporting cases of silicosis, OLDs reports are incomplete from delays in hospital reporting. Table 11 shows the primary reporting source of the 264 persons confirmed with OLDs in 2024. In 2024, the MPC reported 55% of the 264 cases, hospitals reported 19% of the cases, Emergency Medical Services (EMS) system reported 14% of the cases, death certificates accounted for 11%, and Workers' Compensation and physicians each reported 1% of the cases. In 2024, there were no reports from laboratories.

One hundred eighty-nine of the OLDs cases were classified as chemical irritation/irritative bronchitis, 28 had asbestos-related disease, six had chemical pneumonitis, four each had COPD or metal fume fever, three had hypersensitivity pneumonitis, and one each had smoke inhalation, allergies/an anaphylactic reaction, silo related disease or an infectious agent. An additional 26 had a definite work-related respiratory illness that could not be classified more specifically (Table 10).

The following case narratives describe exposures and symptoms related to OLDs cases reported in 2024:

Case 1-Chemical Irritation. A male in his teens developed breathing issues after being exposed to welding fume while welding without a ventilation hood at an auto manufacturing plant.

Case 2-Chemical Irritation. A male in his teens developed breathing issues after inhaling fumes from improperly mixing a cleaning agent with an alkali cleaner.

Case 3-Chemical Irritation. A male in his 40s developed breathing difficulty while working at a farm where chlorine and an acid were improperly mixed.

Case 4-Asbestosis. A male in his 80s died from asbestosis; he had formerly worked for an asbestos removal company.

In addition to the case narratives above, in 2023 we reported a case of blastomycosis in a male in his 20s who was exposed to moldy paper pulp at a papermill in the Upper Peninsula. He was one of the 162 symptomatic papermill workers, including 18 hospitalized and one worker who died. There were an additional 26 papermill workers who were positive for Blastomyces urine antigen, but who had no clinical diagnosis [15].

TABLE 10 Other Work-Related Lung Diseases Reported 2019-2024												
	2019		2020		2021		2022		2023		2024	
DISEASE	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**
Chemical Irritation/Irritative Bronchitis	174	73	94	58	110	64	139	72	165	80	189	72
Chemical Pneumonitis	0	--	2	1	5	3	3	2	5	2	6	2
Asbestos-Related	3	1	5	3	25	15	12	6	6	3	28	11
Smoke Inhalation	7	3	3	2	3	2	2	1	1	<1	1	<1
COPD	10	4	5	3	5	3	2	1	2	1	4	2
Silo-Related Disease	0	--	1	1	0	--	0	--	0	--	1	<1
Acute Respiratory Distress Syndrome	0	--	0	--	0	--	0	--	0	--	0	--
Allergies/Rhinitis/Anaphylactic Reaction	1	<1	4	2	1	1	2	1	0	--	1	<1
Hard Metal Lung Disease	0	--	0	--	0	--	0	--	0	--	0	--
Hypersensitivity Pneumonitis	5	2	0	--	5	3	6	3	10	5	3	1
Infectious Agent	0	--	3	2	2	1	2	1	0	--	1	<1
Metal Fume Fever	2	1	3	2	3	2	3	2	1	<1	4	2
Sinus– related	0	--	0	--	0	--	0	--	0	--	0	--
Coal Workers' Pneumoconiosis	0	--	0	--	1	1	1	1	0	--	0	--
Pneumoconiosis NOS	0	--	0	--	0	--	0	--	0	--	0	--
Lung Trauma	2	1	0	--	0	--	0	--	0	--	0	--
Respiratory Bronchiolitis	1	<1	0	--	0	--	0	--	0	--	0	--
Lung Cancer	0	--	0	--	0	--	0	--	0	--	0	--
Pneumothorax	0	--	0	--	0	--	0	--	0	--	0	--
Pulmonary Embolism	0	--	0	--	0	--	0	--	0	--	0	--
Beryllium Lung Disease	0	--	0	--	1	1	0	--	0	--	0	--
Vocal Cord Dysfunction	0	--	0	--	0	--	0	--	0	--	0	--
Siderosis	1	<1	0	--	0	--	0	--	1	<1	0	--
Infectious COVID-19			10	6	2	1	2	1	0	--	0	--
Histoplasmosis							1	1	0	--	0	--
Legionnaires							2	1	0	--	0	--
Blastomycosis									2	1	0	--
Polymer Fume Fever									1	<1	0	--
Respiratory Illness NOS	32	13	31	19	9	5	16	8	13	6	26	10
TOTAL	**238**		**161**		**172**		**193**		**207**		**264**	

TABLE 11 Reporting Source for OLDS Cases: 2024		
REPORTING SOURCE	**#**	**%**
Michigan Poison Center	144	55
Hospital	50	19
EMS (Ambulance)	37	14
Death Certificate	28	11
Physician Report	3	1
Workers' Compensation	2	1
Laboratory	0	--
TOTAL	**264**	

Demographic Characteristics

One hundred sixty-three (65%) of the 250 persons with known sex were men; 87 (35%) were women. Sex was unknown for 14 cases. The average age of the OLDS cases was 45, ranging from 16 to 98 years of age.

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 30 cases (11%), followed by construction with 16 (6%), agriculture with six (2%), accommodations and food services and public administration each with five (2%), administrative and support and waste management and remediation services and educational services each with four (2%), health care and auto repair and other services each with three (1%), utilities and retail trade each with two (1%), and mining, transportation and warehousing and arts and entertainment each with 1 (<1%). The 83 individuals with a known workplace with OLDS worked at 83 different facilities. The workplace was unknown for 181 individuals.

TABLE 12
Primary Industrial Exposure for OLDS Cases Reported in 2024

2002 North American Industry Classification System		#	%
11	Ag, Forestry, Fishing & Hunting	6	2
21	Mining	1	<1
22	Utilities	2	1
23	Construction	16	6
31-33	Manufacturing	30	11
44-45	Retail Trade	2	1
48-49	Transportation & Warehousing	1	<1
51	Information	0	--
52	Finance & Insurance	0	--
54	Veterinary Services	0	--
56	Administrative & Support & Waste Mgt & Remediation Svcs	4	2
61	Educational Services	4	2
62	Health Care & Social Assistance	3	1
71	Arts, Entertainment, & Rec	1	<1
72	Accommodation & Food Services	5	2
81	Auto Repair, Dry Cleaning, etc	3	1
92	Public Administration	5	2
00	Unknown	181	69
TOTAL		264	

MIOSHA Inspections-Industrial Hygiene Results

There were no inspections in 2023 or 2024. In 2022 there was one inspection. The worker was exposed to urethane and other foam products in a facility manufacturing these chemicals. Co-workers were interviewed about their breathing symptoms; eight of 23 co-workers interviewed indicated they experienced daily or weekly shortness of breath, chest tightness, wheezing or had developed asthma since working at the company. The company was fined $7,910 and issued two serious violations; one violation was related to respiratory protection (no medical evaluation or fit testing for the workers wearing respirators) and the other was related to medical services and first aid (no eye wash station and unsanitary conditions).

Discussion

We have been tracking the occurrence of silicosis since 1988. In the 1990's through 2005, there were 30-70 new cases of silicosis identified each year, from 2006-2015 there were 10-20 and since 2016 under 10 new cases of silicosis per year. Although manufacturing, including foundries, continues to be the most common source of exposure to silica, the percentage of cases of silicosis from exposure to silica in foundries has decreased to 63% while cases from construction have increased to 23% and cases from mining have increased to 11% [4]. The decrease in reports of silicosis can be attributed to downsizing in the foundry industry due to closure of facilities and a decrease in the foundry workforce from increased automation (Figure 6). The Michigan surveillance system has not seen an increase in diagnosed cases since the 2018 Michigan OSHA regulations that first required employers to provide medical screening for silica exposed workers nor from emerging industries with silica exposure including hydraulic fracturing [16], engineered stone countertop fabrication [17] or highway reconstruction. Michigan workers continue to be at risk of developing silicosis because of continued use of silica by approximately a third of the abrasive blasting companies'

inadequate controls in the construction industry, and at foundries currently in operation. Further evaluation of exposures and tracking of silicosis in these industries will be important to assure adequate exposure controls. Even without the development of silicosis, silica exposure is a risk factor for the development of lung cancer, connective tissue disease, tuberculosis and chronic obstructive pulmonary disease (COPD) [18,189,20]. These risks justify ongoing assurance of workplace controls for silica even if new cases of silicosis are not identified.

The main characteristics of the individuals reported during Michigan's 36 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 1960s [21]. The older age of the patient (average year of birth, 1925) is secondary to the chronic nature of the disease and the typical long exposure to silica 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 six in the 2000s. Overall, 100 (8.8%) of 1,136 silicosis cases with known duration worked for less than 10 years. One hundred thirty-five (11.8%) of the 1,140 individuals with known decade of hire began work in the 1970s, 1980s, 1990s or 2000s; 32 of them had worked for less than ten years. Individuals with silicosis who began working since the 1970s were more likely to have done sandblasting than those who began working with silica before 1970 (53% vs. 34%). Of the 43 people who first were exposed to silica since the 1980s, nine worked in foundries, five worked in auto manufacturing, four worked in construction, three did cement/masonry work, two were buffing and polishing metal, two worked in auto repair, two worked at a tool and die shop, two were an owner/operator/laborer of a sandblasting business, 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 was a painter/sandblaster, one was a welder/sandblaster, one worked as a miner in gold fields in the Southwest, one welded, one worked in a boiler fabrication shop, one worked for a small sandpaper manufacturing operation, one was an oiler in an iron ore mine, one worked at a bronze foundry, one was a plumber, and one was a truck driver for a sand and gravel mine.

Black men are over-represented (37%), reflecting previous hiring practices in foundries [22]. Black workers consistently had higher incidence rates of silicosis than their white counterparts in the counties where rates were compared between these groups (Table 4). Overall, for the state, the average annual incidence of silicosis among Black workers was 5.9 per 100,000 versus 1.2 per 100,000 for white workers (a 4.9-fold greater incidence rate).

The individuals reported generally have advanced disease: 284 (23.1%) with progressive massive fibrosis and another 439 (35.8%) with advanced simple silicosis (category 2 or 3). Only 25% of the reported patients had normal breathing tests [4]. Individuals had both restrictive and obstructive changes. Obstructive changes, although more prevalent among individuals who had smoked cigarettes, were found in half of the individuals who never smoked cigarettes (Table 3). The incidence of TB in the confirmed silicosis cases was 7%; this is 1,000-fold greater than that in the general population in the last decade [4]. Despite the severity of their disease, 63% had not applied for Workers' Compensation. Of the 990 with known workers' compensation filing status, 368 (37%) applied and 622 (63%) did not apply. Of the 368 who applied, 278 (77%) were awarded, 28 (8%) were denied, for 54 (15%) the claim was pending at time of interview, and for eight (2%) the award status was unknown.

The reports of Michigan workers with silicosis having obstructive lung changes is consistent with published reports of increased chronic obstructive pulmonary disease (COPD) among workers with silicosis, as well as among individuals without silicosis who have had silica exposure [18]. Individuals with silicosis are at risk of developing pulmonary hypertension, clinically significant bronchitis and COPD [23].

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 [24]. 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 [24].

Individuals with silica exposure have an increased morbidity and mortality for malignant and non-malignant respiratory disease [1,19]. The increased risk for death is found both in patients who ever or never smoked cigarettes

[1]. Individuals with silica exposure also have an increased risk of developing connective tissue disease, particularly rheumatoid arthritis [25,26] as well as an increased risk of developing chronic renal disease, especially anti-neutrophilic cytoplasmic antibodies (ANCA) positive disease [27,28,29].

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. A paper using national Medicare data on hospitalizations estimated 3,260-7,105 cases per year [30]. 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. Based on the results of the national Medicare data and our extrapolation from national death certificate 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, the last year available, 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 39% 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.

Asbestos-related disease, both malignant and non-malignant, like silicosis, continues to have a downward trend in reported cases. Unlike silica, there is little use of asbestos in new production, but risk still remains from asbestos still being present, such as in older buildings and automobile brakes. Asbestos-related disease is tracked from a variety of reporting sources in Michigan, including hospital inpatient discharge data, the 3rd Judicial Circuit Court, death certificates, and an annual survey of physicians in Michigan who are certified B-Readers.

Targeting smoking cessation programs and low dose computed tomography (CT) screening for lung cancer to individuals who work or used to work with asbestos should be a high priority. Guidelines for lung cancer screening from the U.S. Preventive Services Task Force recommend low-dose CT scans for adults 50 to 80 years of age who have at least a 20-pack-year cigarette smoking history and currently smoke or quit smoking less than 15 years prior [31]. The guidelines do not mention asbestos exposure as a criterion. Given the known synergism between cigarettes and asbestos in increasing the risk of lung cancer for either exposure alone, supports screening individuals 50 to 80 with 20 years of asbestos exposure who ever smoked cigarettes regardless of whether they quit. For more information on the background for including asbestosis and asbestos exposure history in the determination for performing screening for lung cancer, see the PS News Winter 2024 newsletter (V35N1) at: www.oem.msu.edu. Similar data for silicosis and silica exposure are not available, but such screening should also be considered for these individuals. For more information on considering occupational exposure to substances and occupations classified as Group I known human carcinogens by the International Agency for Research on Cancer (IARC) see position statement published by the Collegium Ramazzini [32].

The 14th year of OLDs surveillance resulted in the identification of a variety of respiratory illnesses from workplace exposures. 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.

New initiatives are planned in the coming years. One initiative is compiling a list of stone countertop fabricators in Michigan. There has been an epidemic of severe silicosis among stone countertop fabricators in California; men in their 40's who have worked 10-20 years fabricating stone countertops are developing progressive massive fibrosis, needing lung transplants and dying [33]. Once a list is compiled, outreach will be conducted to offer training on product substitution and other ways to reduce exposure to silica as well as medical monitoring. A second initiative is to expand the use of reporting via electronic medical records to potentially improve identification of asbestosis and

silicosis cases that hospitals may inadvertently not be reporting.

References

[1] Rosenman KD, Stanbury MJ, Reilly MJ. Mortality Among Persons with Silicosis Reported to Two State-Based Surveillance Systems. Scand J Work Environ Health 1995; 21 Supplement 2:73-76.
[2] Rosenman KD, Reilly MJ, Henneberger PK. Estimating the Total Number of Newly Diagnosed Silicotics in the United States. Am J Ind Med 2003; 44: 141-147.
[3] Rosenman KD, Reilly MJ, Gardiner J. Results of Spirometry among Individuals in a Silicosis Registry. J Occup Environ Med 2010; 52: 1173-1178.
[4] Reilly MJ, Timmer SJ, Rosenman KD. The Burden of Silicosis in Michigan, 1988-2016. Annals Am Thoracic Society 2018; 15: 1404-1410.
[5] Kurth L, Casey ML, Mazurek JM, Blackley DJ. Pneumoconiosis incidence and prevalence among US Medicare beneficiaries, 1999-2019. Am J Ind Med 2023; 66:831-841.
[6] Rosenman KD, Trimbath L, Stanbury M. Surveillance of Occupational Lung Disease: Comparison of Hospital Discharge Data to Physician Reporting. Am J Public Health 1990; 80:1257-1258.
[7] Greenberg M. History of Mesothelioma. European Respiratory Journal 1997; 10:2690-2691.
[8] Lemen RA. Mesothelioma from asbestos exposures: Epidemiologic patterns and impact in the United States. J Tox Environ Health, Part B 2016;19:250-265.
[9] Leigh J, Davidson P, Hendrie L, Berry D. Malignant mesothelioma in Australia 1945-2000. Ann Occ Hyg 2002; 46:160-165
[10] Spirtas R, Heineman E, Bernstein L, Beebe GW, Keehn RJ, Stark A, Harlow BL and Benichou J. Malignant Mesothelioma: Attributable Risk of Asbestos Exposure. Occup Environ Med 1994; 51: 804-811.
[11] Mazurek JM, Syamlal G, Wood JM, Hendricks SA, Weston A. Malignant Mesothelioma Mortality - United States, 1999- 2015. MMWR 2017;66:214-218.
[12] Mazurek JM, Blackley DJ, Weissman DN. Malignant Mesothelioma Mortality in Women - United States, 1999-2020. MMWR 2022; 71:645-649.
[13] Liu B, Niu L, Boscoe F, Lee FF. Predictors of Survival among Male and Female Patients with Malignant Pleural Mesothelioma: A Random Survival Forest Analysis of Data from the 2000-2017 Surveillance, Epidemiology, and End Results Program. J Registry Manag 2021;48:118-125.
[14] Choi AY, Singh A, Wang D, Pittala K, Hoang CD. Current State of Pleural-Directed Adjuncts Against Malignant Pleural Mesothelioma. Front Oncol 2022; 12:886430. Doi 10.339/fonc.2022.886430.
[15] Harvey RR, O'Connor AW, Stanton ML, et al. Outbreak of Blastomycosis Among Paper Mill Workers — Michigan, November 2022–May 2023. MMWR 2025; 73:1157-1162
[16] Rosenman KD. Hydraulic Fracturing and the Risk of Silicosis. Clinical Pulmonary Medicine. 2014; 21: 167-172.
[17] Heinzerling A, Cummings KJ, Flattery J, Weinberg JL, Materna B, Harrison R. Radiologic screening reveals high burden of silicosis among workers at an engineered stone countertop fabrication facility in California. Am J Resp Crit Care Med 2021; 203:764-767.
[18] Hnizdo E, Vallyathan V. Chronic Obstructive Pulmonary Disease Due to Occupational Exposure to Silica Dust: A Review of Epidemiological and Pathological Evidence. Occup Environ Med 2003; 60:237-243.
[19] Davis GS. Silica in Occupational and Environmental Respiratory Disease. Eds Harber P, Schenker MD, Balmes JR. St. Louis, Missouri: Mosby, 1996; 373-399.
[20] NIOSH Hazard Review. Health Effects of Occupational Exposure to Respirable Crystalline Silica. Cincinnati, Ohio: DHHS (NIOSH) 2002-129.
[21] Trasko VM. Some Facts on the Prevalence of Silicosis in the United States. AMA Archives of Industrial Health 1956; 14:379-386.

[22] Foote CL, Whatley WC, Wright G. Arbitraging a Discriminatory Labor Market: Black Workers at the Ford Motor Company, 1918-1947. J Labor Economics 2003; 21: 493-532.
[23] Rosenman KD, Zhu Z. Pneumoconiosis and Associated Medical Conditions. Am J Ind Med 1995; 27: 107-113.
[24] Rosenman KD, Hogan A, Reilly MJ. What is the Most Cost-Effective Way to Identify Silica Problem Worksites? Am J Ind Med 2001; 39: 629-635.
[25] Makol A, Reilly MJ, Rosenman KD. Prevalence of Connective Tissue Disease in Silicosis (1985-2006). Am J Ind Med 2011; 54: 255-262.
[26] Rosenman KD, Moore-Fuller M, Reilly MJ. Connective Tissue Disease and Silicosis. Am J Ind Med 1999; 35: 375-381.
[27] Rosenman KD, Moore-Fuller M, Reilly MJ. Kidney Disease and Silicosis. Nephron 2000; 85: 14-19.
[28] Gregorini G, Tira P, Frizza J, D'Haese PC, Elseviers MM, Nuyts GD, Maiorcar, DeBroe ME. ANCA-Associated Diseases and Silica Exposure. Clin Rev Allergy Immunol 1997; 15: 21-40.
[29] Steenland K, Rosenman KD, Socie E, Valiante D. Silicosis and End-Stage Renal Disease. Scand J Work Environ Health 2002; 28: 439-442.
[30] Casey ML and Mazurek JM. Silicosis prevalence and incidence among Medicare beneficiaries. AJIM 2019; 62: 183-191.
[31] USPSTF. Final Recommendation Statement. Lung Cancer: Screening 3/9/21. https://www.uspreventiveservicestaskforce.org/uspstf/recommendation/lung-cancer-screening
[32] Markowitz S, Ringen K, Dement JM, Straif K, Christine Oliver L, Algranti E, Nowak D, Ehrlich R, McDiarmid MA, Miller A; Collegium Ramazzini. Occupational lung cancer screening: A Collegium Ramazzini statement. Am J Ind Med 2024; 67:289-303.
[33] Heinzerling A, Flattery J, Cummings KJ, Harrison RJ, Fazio JC, Gandhi SA, Khan A, Michaels D. Silicosis among Workers Fabricating Engineered Stone ("Quartz") Countertops in California, 2019–2026. NEJM Evid. 2026 Sep;5(9):EVIDpha2600187.