

Surveillance for Silicosis — Michigan and New Jersey, 2003–2011

Patricia L. Schleiff, MS¹
 Jacek M. Mazurek, MD, PhD¹
 Mary Jo Reilly, MS²
 Kenneth D. Rosenman, MD²
 Martha B. Yoder, MS³
 Margaret E. Lumia, PhD⁴
 Karen Worthington, MS⁴

¹Respiratory Health Division, National Institute for Occupational Safety and Health, CDC

²Division of Occupational and Environmental Medicine, Michigan State University, East Lansing, Michigan

³Michigan Department of Licensing and Regulatory Affairs, Lansing, Michigan

⁴Environmental and Occupational Health Surveillance Program, New Jersey Department of Health, Trenton, New Jersey

Preface

CDC's National Institute for Occupational Safety and Health (NIOSH), state health departments, and other state entities maintain a state-based surveillance program of confirmed silicosis cases. Data on confirmed cases are collected and compiled by state entities and submitted to CDC. This report summarizes information for cases of silicosis that were reported to CDC for 2003–2011 by Michigan and New Jersey, the only states that continue to provide data voluntarily to NIOSH. The data for this report were final as of January 8, 2015. Data are presented in tabular form on the number and distribution of cases of silicosis by year (Table 1), duration of employment in occupations with potential exposure to dust containing respirable crystalline silica (Table 2), industry (Table 3), and occupation (Table 4). The number of cases by year is presented graphically (Figure). This report is a part of the *Summary of Notifiable Noninfectious Conditions and Disease Outbreaks — United States*, which encompasses various surveillance years but is being published in 2016 (1). The *Summary of Notifiable Noninfectious Conditions and Disease Outbreaks* appears in the same volume of *MMWR* as the annual *Summary of Notifiable Infectious Diseases* (2).

Background

Silicosis, a form of pneumoconiosis, is a progressive occupational lung disease caused by the inhalation, deposition, and retention of respirable dust containing crystalline silica. There is no effective specific treatment, and patients with silicosis can be offered only supportive care. Silicosis is preventable by using nonsilica substitution materials, effective

dust control measures, and personal protective equipment.* Occupational exposure to respirable dust containing crystalline silica occurs in mining, quarrying, sandblasting, rock drilling, construction, pottery making, stone masonry, and tunneling operations (3). The Occupational Safety and Health Administration (OSHA) estimates that >2 million workers are currently exposed† to respirable crystalline silica in industries where exposure might occur, including 1.85 million workers in the construction industry and 320,000 workers in general industry and maritime workplaces (4,5). Typically a disease of long latency, silicosis usually is diagnosed through a chest radiograph after ≥10 years of exposure to respirable

*General information concerning the hierarchy of hazard exposure controls is available at <http://www.cdc.gov/niosh/engcontrols>; information on control measures specific to crystalline silica is available at https://www.osha.gov/dsg/topics/silicacrystalline/control_measures_silica.html.

†National compliance standards for silica dust exposure (the Mine Safety and Health Administration [MSHA] and the Occupational Safety and Health Administration [OSHA]) use permissible exposure limits (PEL) based on the American Conference of Governmental Industrial Hygienists threshold limit value. These began to be applied in the early 1970s and included limits on exposure to silica through regulation of respirable mixed mine dust in underground coal mines using the MSHA's formula: $(10 \text{ mg/m}^3)/(\% \text{ quartz})$, and direct limits on exposure to crystalline silica as respirable quartz using the formulas: $(10 \text{ mg/m}^3)/(\% \text{ quartz} + 2)$ for metal/nonmetal mining and general industry or $(250 \text{ million particles per cubic foot})/(\% \text{ quartz} + 5)$ for the construction industry (currently for the construction industry, sampling, analysis, and calculations are the same as general industry, except an additional calculation to convert to millions of particles per cubic foot is conducted to determine overexposure according to OSHA's National Emphasis Program—Crystalline Silica at https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=DIRECTIVES&p_id=3790). For more information, see Lowering Miners' Exposure to Respirable Coal Mine Dust, Including Continuous Personal Dust Monitors; Final Rule, available at <https://www.gpo.gov/fdsys/pkg/FR-2014-05-01/pdf/2014-09084.pdf>, Criteria for a Recommended Standard: Occupational Exposure to Respirable Coal Mine Dust at <http://www.cdc.gov/niosh/docs/95-106/pdfs/95-106.pdf>, Occupational Safety and Health Standards, Toxic and Hazardous Substances, 1910.1000, TABLE Z-3 Mineral Dusts at https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9994, Safety and Health Regulations for Construction, Occupational Health and Environmental Controls, 1926.55 App A, Gases, vapors, fumes, dusts, and mists at https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10629, and OSHA Frequently Asked Questions, Silica Advisor at <https://www.osha.gov/dsg/etools/silica/faq/faq.html>.

Corresponding author: Patricia L. Schleiff, Respiratory Health Division, National Institute for Occupational Safety and Health, CDC. Telephone: 304-285-5874; E-mail: pls1@cdc.gov.

TABLE 1. Number and percentage* of silicosis cases, by year — Michigan and New Jersey, 2003–2011

Year	Michigan	New Jersey	Total
	No. (%)	No. (%)	No. (%)
2003	34 (16.8)	7 (7.8)	41 (14.0)
2004	28 (13.9)	16 (17.8)	44 (15.1)
2005	30 (14.9)	8 (8.9)	38 (13.0)
2006	19 (9.4)	10 (11.1)	29 (9.9)
2007	22 (10.9)	11 (12.2)	33 (11.3)
2008	23 (11.4)	16 (17.8)	39 (13.4)
2009	14 (6.9)	7 (7.8)	21 (7.2)
2010	21 (10.4)	8 (8.9)	29 (9.9)
2011	11 (5.4)	7 (7.8)	18 (6.2)
Total	202 (100.0)	90 (100.0)	292 (100.0)

Source: Sentinel surveillance data as of January 8, 2015.

* Percentages might not sum to 100% due to rounding.

TABLE 2. Number and percentage* of silicosis cases, by number of years of employment in jobs with potential exposure to silica — Michigan and New Jersey, 2003–2011

No. yrs. employment	Michigan	New Jersey	Total
	No. (%)	No. (%)	No. (%)
<10	20 (9.9)	8 (8.9)	28 (9.6)
10–19	19 (9.4)	17 (18.9)	36 (12.3)
20–29	54 (26.7)	10 (11.1)	64 (21.9)
30–39	57 (28.2)	10 (11.1)	67 (22.9)
≥40	25 (12.4)	9 (10.0)	34 (11.6)
Unknown	27 (13.4)	36 (40.0)	63 (21.6)
Total	202 (100.0)	90 (100.0)	292 (100.0)

Source: Sentinel surveillance data as of January 8, 2015.

* Percentages might not sum to 100% due to rounding.

TABLE 3. Number and percentage* of silicosis cases, by primary industry — Michigan and New Jersey, 2003–2011

Industry (NAICS 2002)	Michigan	New Jersey	Total
	No. (%)	No. (%)	No. (%)
Agriculture, forestry, fishing and hunting	1 (0.5)	1 (1.1)	2 (0.7)
Mining	17 (8.4)	12 (13.3)	29 (9.9)
Mining (except oil and gas) (212)	17 (8.4)	11 (12.2)	28 (9.6)
All other mining industries (213)	— [†] (—)	1 (1.1)	1 (0.3)
Construction	34 (16.8)	23 (25.6)	57 (19.5)
Specialty trade contractors (238)	32 (15.8)	15 (16.7)	47 (16.1)
Heavy and civil engineering construction (237)	2 (1.0)	5 (5.6)	7 (2.4)
All other construction industries (236)	— (—)	3 (3.3)	3 (1.0)
Manufacturing	139 (68.8)	45 (50.0)	184 (63.0)
Primary metal manufacturing (331)	106 (52.5)	3 (3.3)	109 (37.3)
Nonmetallic mineral product manufacturing (327)	10 (5.0)	28 (31.1)	38 (13.0)
Transportation equipment manufacturing (336)	13 (6.4)	2 (2.2)	15 (5.1)
Miscellaneous manufacturing (339)	4 (2.0)	3 (3.3)	7 (2.4)
Fabricated metal product manufacturing (332)	3 (1.5)	3 (3.3)	6 (2.1)
All other manufacturing industries (325, 333–335)	3 (1.5)	6 (6.7)	9 (3.1)
Wholesale trade	1 (0.5)	— (—)	1 (0.3)
Retail trade	1 (0.5)	— (—)	1 (0.3)
Transportation and warehousing	2 (1.0)	2 (2.2)	4 (1.4)
Professional, scientific, and technical services	— (—)	1 (1.1)	1 (0.3)
Administrative and support and waste management and remediation services	— (—)	1 (1.1)	1 (0.3)
Health care and social assistance	1 (0.5)	— (—)	1 (0.3)
Arts, entertainment, and recreation	— (—)	1 (1.1)	1 (0.3)
Other services (except public administration)	4 (2.0)	3 (3.3)	7 (2.4)
Repair and maintenance (811)	4 (2.0)	3 (3.3)	7 (2.4)
Public administration	(0.5)	— (—)	1 (0.3)
Unclassified	1 (0.5)	1 (1.1)	2 (0.7)
Total	202 (100.0)	90 (100.0)	292 (100.0)

Abbreviation: NAICS = North American Industry Classification System.

Source: Sentinel surveillance data as of January 8, 2015.

* Percentages might not sum to 100% due to rounding.

[†] Indicates no cases reported.

crystalline silica dust. Nodular silicosis also can develop within 5–10 years of exposure to higher concentrations of crystalline silica. A clinical continuum exists between the accelerated and the chronic forms of silicosis. Acute silicosis has a different

pathophysiology than accelerated or chronic silicosis in that it might develop within weeks of initial exposure and is associated with exposures to extremely high concentrations[†] of crystalline silica. Respiratory impairment is severe, and the

TABLE 4. Number and percentage* of silicosis cases, by primary occupation — Michigan and New Jersey, 2003–2011

Occupation (COC 2000)	Michigan	New Jersey	Total
	No. (%)	No. (%)	No. (%)
Management (022)	—† (—)	1 (1.1)	1 (0.3)
Architecture and engineering (145, 150)	1 (0.5)	2 (2.2)	3 (1.0)
Healthcare practitioners and technical (313)	1 (0.5)	— (—)	1 (0.3)
Protective service (374)	1 (0.5)	— (—)	1 (0.3)
Building and grounds cleaning and maintenance	5 (2.5)	2 (2.2)	7 (2.4)
Janitors and building cleaners (422)	5 (2.5)	1 (1.1)	6 (2.1)
Grounds maintenance workers (425)	— (—)	1 (1.1)	1 (0.3)
Office and administrative support (561, 562, 570)	3 (1.5)	— (—)	3 (1.0)
Farming, forestry, and fishing (605)	— (—)	1 (1.1)	1 (0.3)
Construction and extraction	50 (24.8)	32 (35.6)	82 (28.1)
Construction laborers (626)	20 (9.9)	9 (10.0)	29 (9.9)
Brickmasons, blockmasons, and stonemasons (622)	11 (5.4)	2 (2.2)	13 (4.5)
Other extraction workers (694)	7 (3.5)	2 (2.2)	9 (3.1)
All other construction and extraction occupations (620–621, 623–625, 632, 635–636, 642, 644, 652–653, 660, 673, 682–684)	12 (5.9)	19 (21.1)	31 (10.6)
Installation, repair, and maintenance (712, 715, 722, 733–735, 762)	7 (3.5)	8 (8.9)	15 (5.1)
Production	115 (56.9)	35 (38.9)	150 (51.4)
Production workers, all other (896)	39 (19.3)	2 (2.2)	41 (14.0)
Molders and molding machine setters, operators, and tenders, metal and plastic (810)	27 (13.4)	1 (1.1)	28 (9.6)
Grinding, polishing, and buffing machine tool setters, operators, and tenders, metal and plastic (800)	17 (8.4)	1 (1.1)	18 (6.2)
Metal furnace and kiln operators and tenders (804)	9 (4.5)	— (—)	9 (3.1)
Crushing, grinding, polishing, mixing, and blending workers (865)	4 (2.0)	5 (5.6)	9 (3.1)
First—line supervisors/managers of production and operating workers (770)	6 (3.0)	1 (1.1)	7 (2.4)
Molders, shapers, and casters, except metal and plastic (892)	— (—)	7 (7.8)	7 (2.4)
Inspectors, testers, sorters, samplers, and weighers (874)	3 (1.5)	3 (3.3)	6 (2.1)
Painting workers (881)	2 (1.0)	4 (4.4)	6 (2.1)
Miscellaneous assemblers and fabricators (775)	— (—)	5 (5.6)	5 (1.7)
All other production occupations (801, 803, 813–814, 822, 831, 875–876)	8 (4.0)	6 (6.7)	14 (4.8)
Transportation and material moving (913, 920, 961–963)	4 (2.0)	8 (8.9)	12 (4.1)
Unclassifiable	15 (7.4)	1 (1.1)	16 (5.5)
Total	202 (100.0)	90 (100.0)	292 (100.0)

Abbreviation: COC = Census Occupation Code by the U.S. Census Bureau.

Source: Sentinel surveillance data as of January 8, 2015.

* Percentages might not sum to 100% due to rounding.

† Indicates no cases reported.

disease is usually fatal within a year of diagnosis. In addition, occupational exposure to respirable crystalline silica puts workers at increased risk for other serious health conditions, including chronic obstructive lung disease, kidney and connective tissue disease, tuberculosis and other mycobacterial-related diseases, and lung cancer (6). In 1997, the International Agency for Research on Cancer (IARC) classified crystalline silica as carcinogenic to humans (7), and this classification was reconfirmed in 2012 (8).

During 1999–2013, a total of 2,065 decedents (age-adjusted death rate: 0.57 per 1 million persons aged ≥15 years) had silicosis listed as the cause of death on the death certificate. §

§ Source: CDC, National Center for Health Statistics, Multiple Cause-of-Death data files, 1999–2013 on CDC WONDER Online Database, released 2015, as compiled from data provided by the 57 vital statistics jurisdictions through the Vital Statistics Cooperative Program (<http://wonder.cdc.gov/mcd-icd10.html>).

The annual number of silicosis deaths declined from 185 in 1999 to 111 in 2013 (9,10). Analysis of 1968–2005 data indicated that silicosis-attributable years of potential life lost before age 65 years decreased substantially during 1968–2005, but the decline slowed during the last 10 years of that period (11). However, the number of hospitalizations for which silicosis was listed as one of the discharge diagnoses did not decline during 1997–2011. ¶ Cases of silicosis continue to occur despite the existence of legally enforceable exposure limits. † In 2014, silicosis with progressive massive fibrosis was observed in a male aged 37 years who worked for an engineered stone countertop company as a polisher, laminator, and fabricator (12). Silicosis in any of its clinical forms is consistently

¶ Source: Agency for Healthcare Research and Quality. HCUPnet, an on-line query system for National Statistics on All Stays (<http://hcupnet.ahrq.gov>).

undercounted by the Survey of Occupational Injuries and Illnesses, an employer-based surveillance system maintained by the Bureau of Labor Statistics (13). An estimated 3,600–7,300 new cases of silicosis might be occurring each year (13). In 2008, the National Academy of Sciences recommended the continuation and expansion of surveillance efforts to prevent silicosis and other interstitial lung diseases (14).

Cases of silicosis are sentinel events that indicate the need for intervention (15). Silicosis was put under nationwide surveillance as part of the National Public Health Surveillance System in 1999** and became a nationally notifiable and standard condition in 2009.†† In 2010, the national surveillance case definition for silicosis was added to CDC's National Notifiable Diseases Surveillance System (NNDSS).§§

Since 2005, NIOSH has supported efforts by states to conduct surveillance for silicosis under the State-Based Occupational Health and Safety Surveillance cooperative agreement. Between 1987 and 2005, different cooperative agreements were in place, including the Sentinel Event Notification system for Occupational Risks (SENSOR). In 1987, some states initiated active silicosis surveillance under SENSOR and began providing data voluntarily to NIOSH (16,17). Since 1992, data summaries have been published in a series of reports.¶¶ The number of states*** that conduct silicosis surveillance varies by year based on funding support by NIOSH. Currently, Michigan and New Jersey are funded to continue to conduct sentinel case-based silicosis surveillance and interventions. These two states are the only states that continue to provide data voluntarily to NIOSH.

This report summarizes data for silicosis cases that met the surveillance case definition for a confirmed silicosis case for 2003–2011 as reported by Michigan and New Jersey. Data from state programs are updated annually and are available through the CDC's Work-Related Lung Disease Surveillance System (eWoRLD).†††

Data Sources

In 1987, some states initiated active silicosis surveillance under SENSOR and began providing data voluntarily to NIOSH (16,17). The number of states conducting silicosis surveillance varies by year.†† Two states, Michigan and New Jersey, continue to conduct sentinel case-based silicosis surveillance and interventions and provide data voluntarily to NIOSH.

Interpreting the Data

In this report, state surveillance data for confirmed silicosis cases are presented by the year of the reporting source, industry, occupation, and duration of employment in occupations with potential exposure to silica dust. The reporting source year is the year of a silicosis-related clinician report, hospital discharge, death, or year of a workers' compensation claim. If a case is ascertained from multiple data sources over multiple years, the year reported is the first year the case is ascertained from any data source.

Reporting practices affect how the data should be interpreted. Silicosis is frequently not recognized or reported by clinicians. Although multiple data sources are used, case ascertainment likely is incomplete. The data provided in this report are based on data from two states and might not be generalizable.

Methods for Identifying Silicosis

State sentinel silicosis surveillance programs identify suspected cases of silicosis through health care provider reports, hospital discharge or outpatient data, state death certificate data, and Workers' Compensation data. Other data sources include the identification by the index case of additional cases among co-workers at a work place, referrals from industrial hygienists conducting inspections at companies, employer screenings, and referrals from other state health departments.

In New Jersey, clinicians and hospitals are required to report cases of silicosis directly to the state health department. In Michigan, physicians, hospitals, clinics or employers are required to report cases of silicosis directly to the Michigan Department of Licensing and Regulatory Affairs or to the state's bona fide agent, Michigan State University.

Cases are confirmed using the surveillance case definition, which requires a history of occupational exposure to airborne silica dust and either or both: 1) a chest radiograph (or other

** Source: Council of State and Territorial Epidemiologists position statement ENV 4 (<http://c.ymcdn.com/sites/www.cste.org/resource/resmgr/PS/1999-ENV-4.pdf>).

†† Source: Council of State and Territorial Epidemiologists position statement 09-OH-01 (<http://c.ymcdn.com/sites/www.cste.org/resource/resmgr/PS/09-OH-01.pdf>).

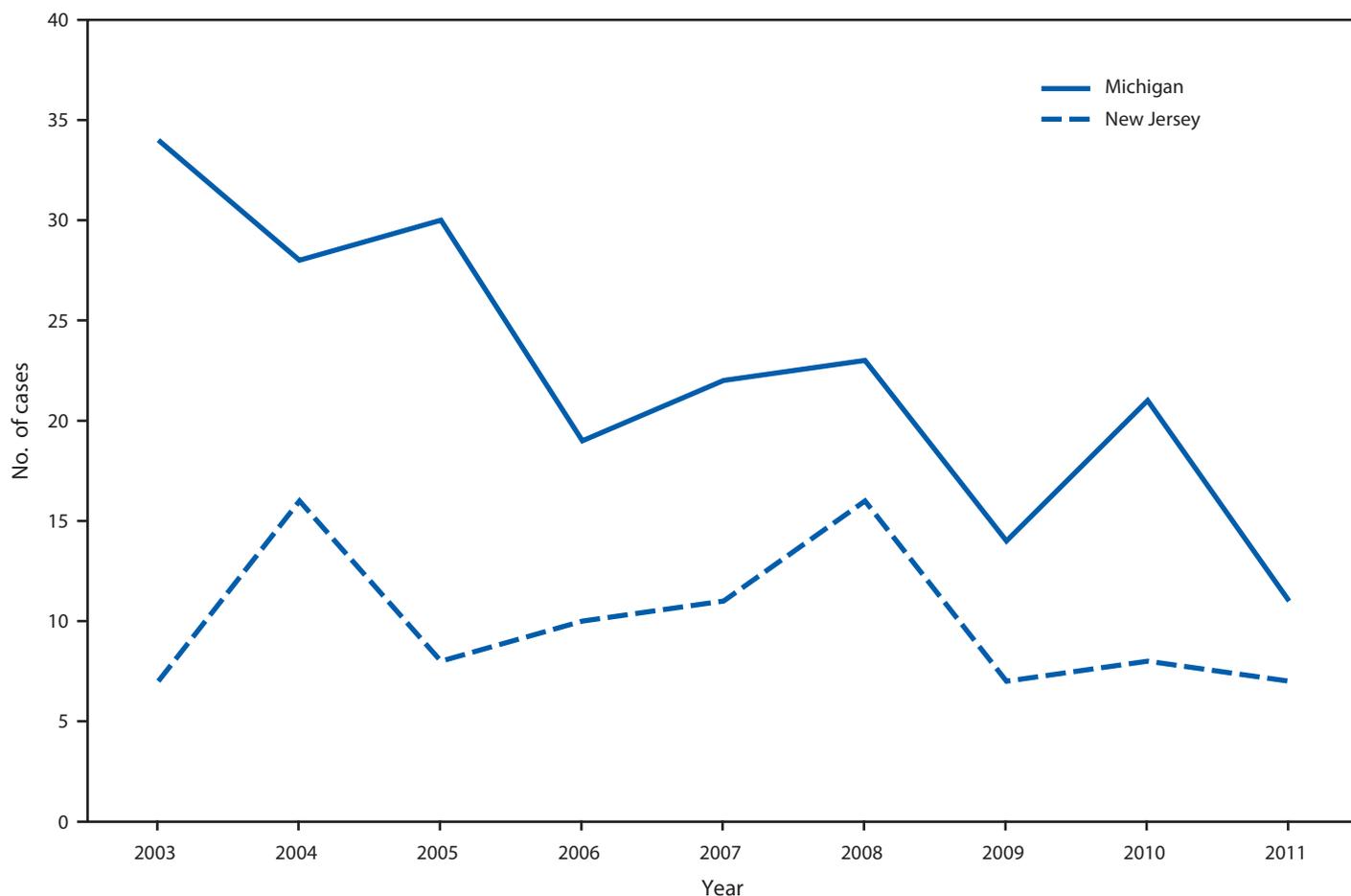
§§ Source: CDC. Silicosis 2010 case definition (<https://wwwn.cdc.gov/nndss/conditions/silicosis/case-definition/2010>).

¶¶ Work-Related Lung Disease (WoRLD) Surveillance Reports are available at <http://www.cdc.gov/niosh/topics/surveillance/ords/NationalStatistics.html>. The most recent data are available at <http://wwwn.cdc.gov/eworld>.

*** A list of states conducting silicosis surveillance is available in Table A-1 on page A-7 at <http://www.cdc.gov/niosh/docs/2008-143/pdfs/2008-143.pdf>.

††† State-based case data are available at <http://wwwn.cdc.gov/eworld/Grouping/Silicosis/94#State-based Case Data>.

FIGURE. Number* of silicosis cases by year — Michigan and New Jersey, 2003–2011



Source: Sentinel surveillance data as of January 8, 2015.

* N = 292 (Michigan: 202; New Jersey: 90).

radiographic image, such as computed tomography) showing abnormalities interpreted as consistent with silicosis; or 2) lung histopathology consistent with silicosis.^{§§} Medical record review and follow-up interviews are conducted with the reported case or their surviving next-of-kin, using a standardized telephone-administered questionnaire.

Publication Criteria

De-identified confirmed cases of silicosis case data are reported voluntarily to NIOSH on an annual basis. All confirmed cases are published.

Highlights

Silicosis is a progressive and preventable occupational lung disease caused by the inhalation, deposition, and retention of respirable dust containing crystalline silica. As a sentinel event, a case of silicosis indicates a failure to prevent exposure to crystalline silica dust.

For the period 2003–2011, silicosis surveillance programs in Michigan and New Jersey identified and confirmed 292 cases; 28 (9.6%) had <10 years of potential exposure to silica dust. The manufacturing, construction, and mining industries accounted for 92% (n = 270) of the cases, with the greatest number of cases (184 [63%]) associated with manufacturing.

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