Occupational Lung Disease (Silicosis) Associated with Engineered Stone Countertop Manufacturing and Fabrication

TCEQ Trade Fair

May 14, 2024

Austin, TX

Silicosis

Results from inhalation of silicon dioxide or by exposure to respirable crystalline silica.

<u>Occupational Exposures to Silica</u>:

- Mining
- Sandblasting
- Quarrying
- Rock Drilling
- Manufacturing
- Agricultural Industries
- Stone Masonry
- Glass Manufacturing
- Construction

Image source:
https://phil.cdc.gov/Details.aspx?pid=22795

Hawk’s Nest Tunnel Tragedy (1930-31)

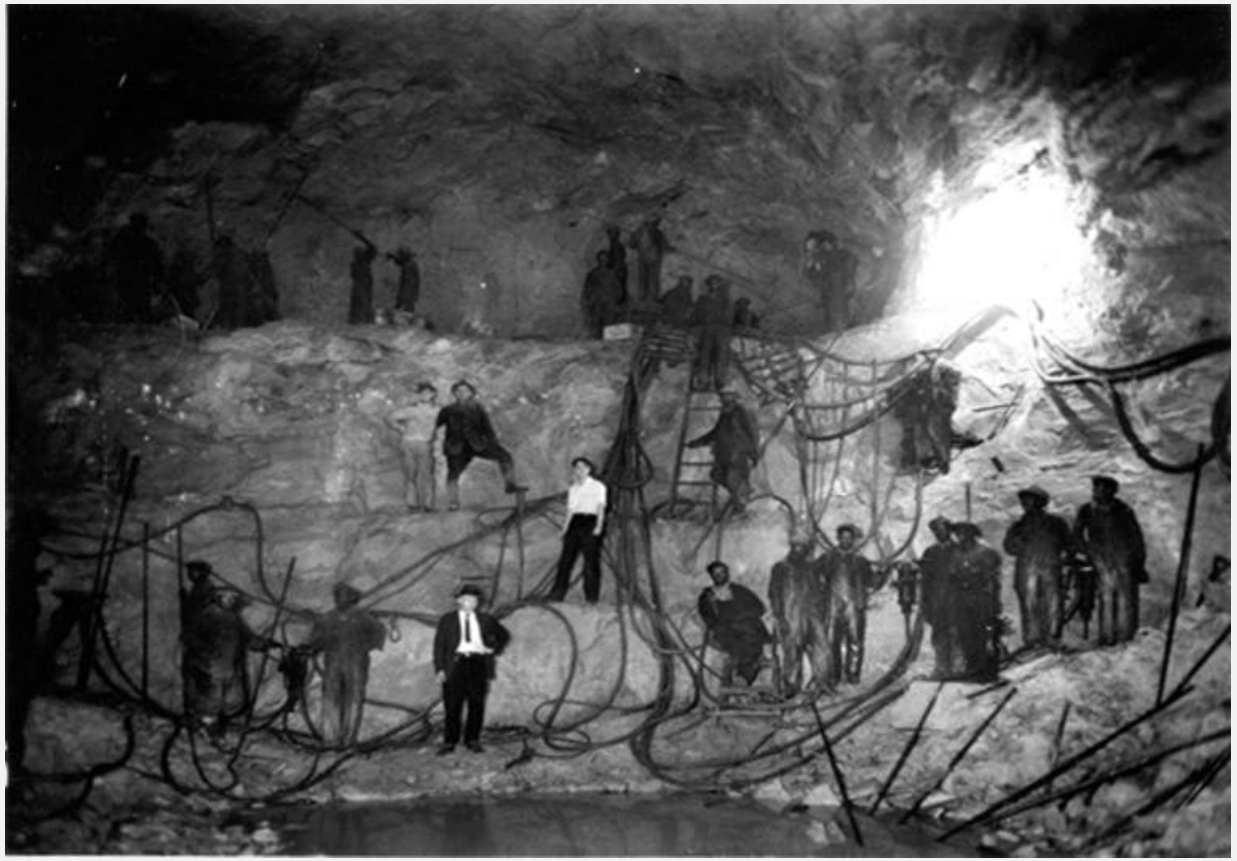


Image Source:
https://img.ehstoday.com/files/base/ebm/ehstoday/image/2019/03/ehstoday_4244_hawks_nest_workers.png?w=768

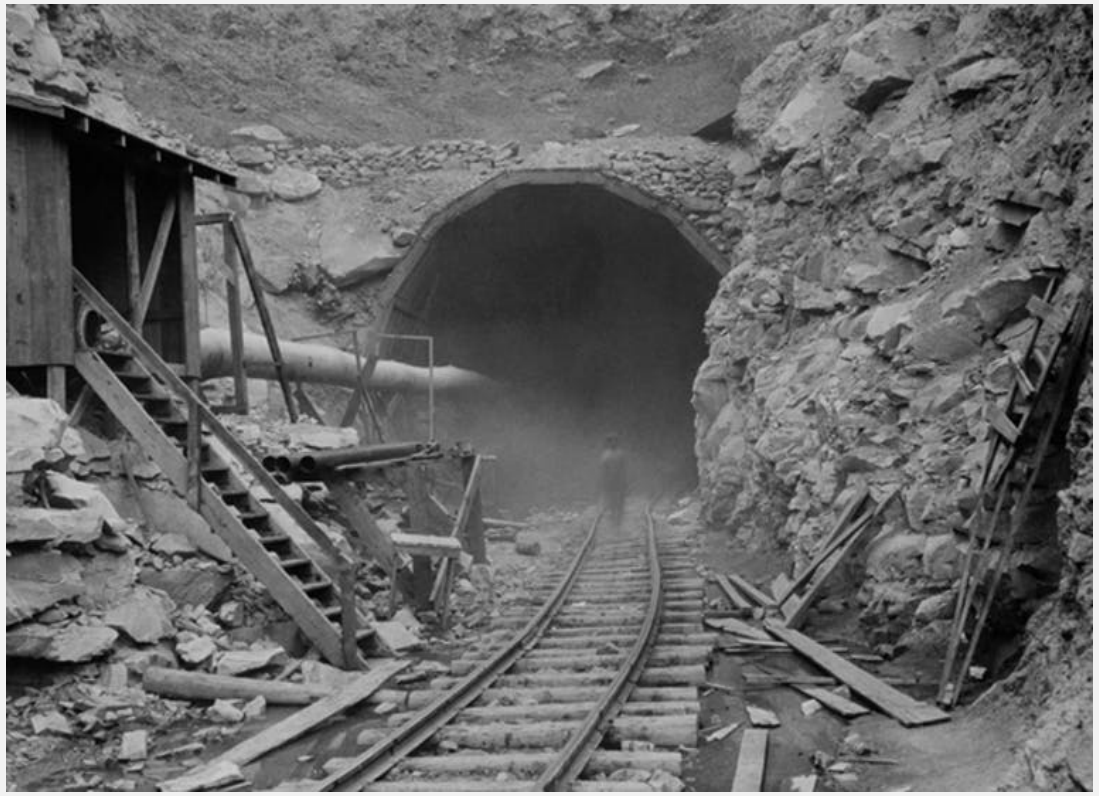


Image Source:
https://img.ehstoday.com/files/base/ebm/ehstoday/image/2019/03/ehstoday_4248_miner_0.png?w=768

Post-war Economy and Silicosis

- Several cases of silicosis were identified among workers in shipyards, offshore oil rigs and oil refineries in Louisiana, Texas, and Mississippi in 1970-80s.[1,2]
- U.S. Occupational Safety and Health Administration (OSHA):
  - Established a Special Emphasis Program for Silicosis in 1996, which was later expanded to a National Emphasis Program in 2008, cancelled in 2017, and re-implemented in 2020[3]

1. Rosner, D., Markowitz, G., Kroll-Smith, S., Brown, P., & Gunter, V. J. (2000). Illness and the Environment.
2. Rosner, D., Markowitz, G., & Markowitz, G. E. (2006). *Deadly dust: Silicosis and the on-going struggle to protect workers' health*. University of Michigan Press.
3. OSHA. National Emphasis Program – Respirable Crystalline Silica https://www.osha.gov/sites/default/files/enforcement/directives/CPL_03-00-023.pdf

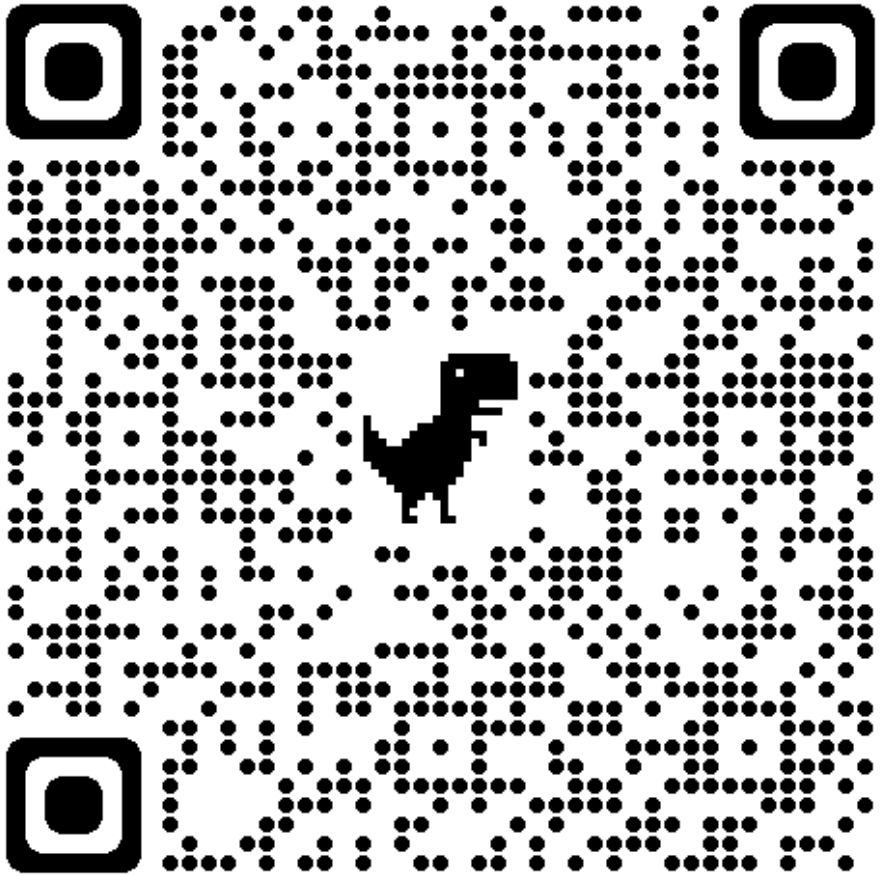
Occupational Lung Disease Surveillance and Prevention in the U.S.

- NIOSH's Work-related Lung Disease Surveillance System (eWoRLD)
- NIOSH's National Occupational Mortality Surveillance (NOMS) program
- State-based Surveillance
  - California, Connecticut, Massachusetts, Michigan, New Jersey, New Mexico, New York, Oregon, Texas, Washington, Wisconsin

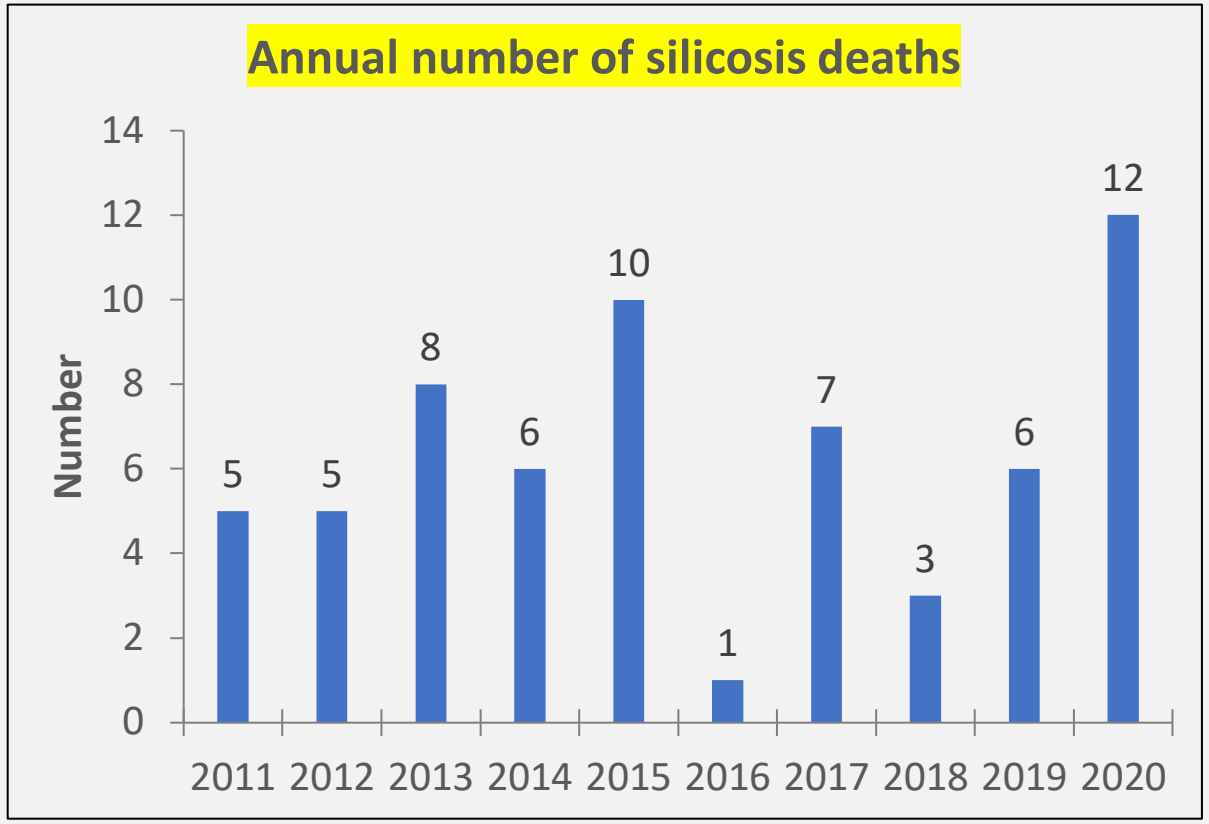
1. eWorld. https://wwwn.cdc.gov/eWorld/
2. NOMS. https://www.cdc.gov/niosh/topics/noms/default.html
3. State-based Surveillance. https://www.cdc.gov/niosh/topics/surveillance/ords/statesurveillance/stateprograms.html

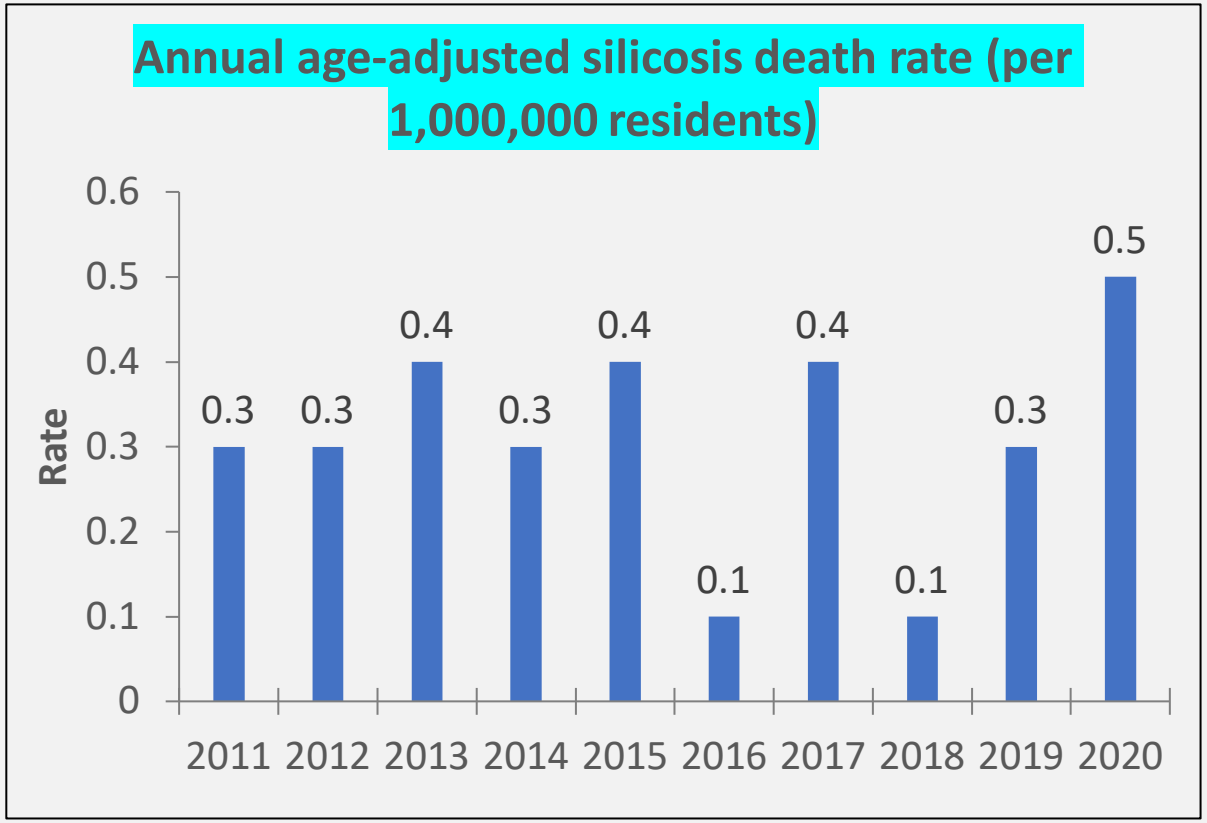
State-based Surveillance for Silicosis in Texas

- Since 1986, silicosis is reportable to the Texas Department of State Health Services (DSHS)
  - Texas Administrative Code, Title 25, Rule 99.1
- DSHS monitors silicosis using data from:
  - Case reports by health care providers
  - Hospital discharge information, and
  - Death certificate records



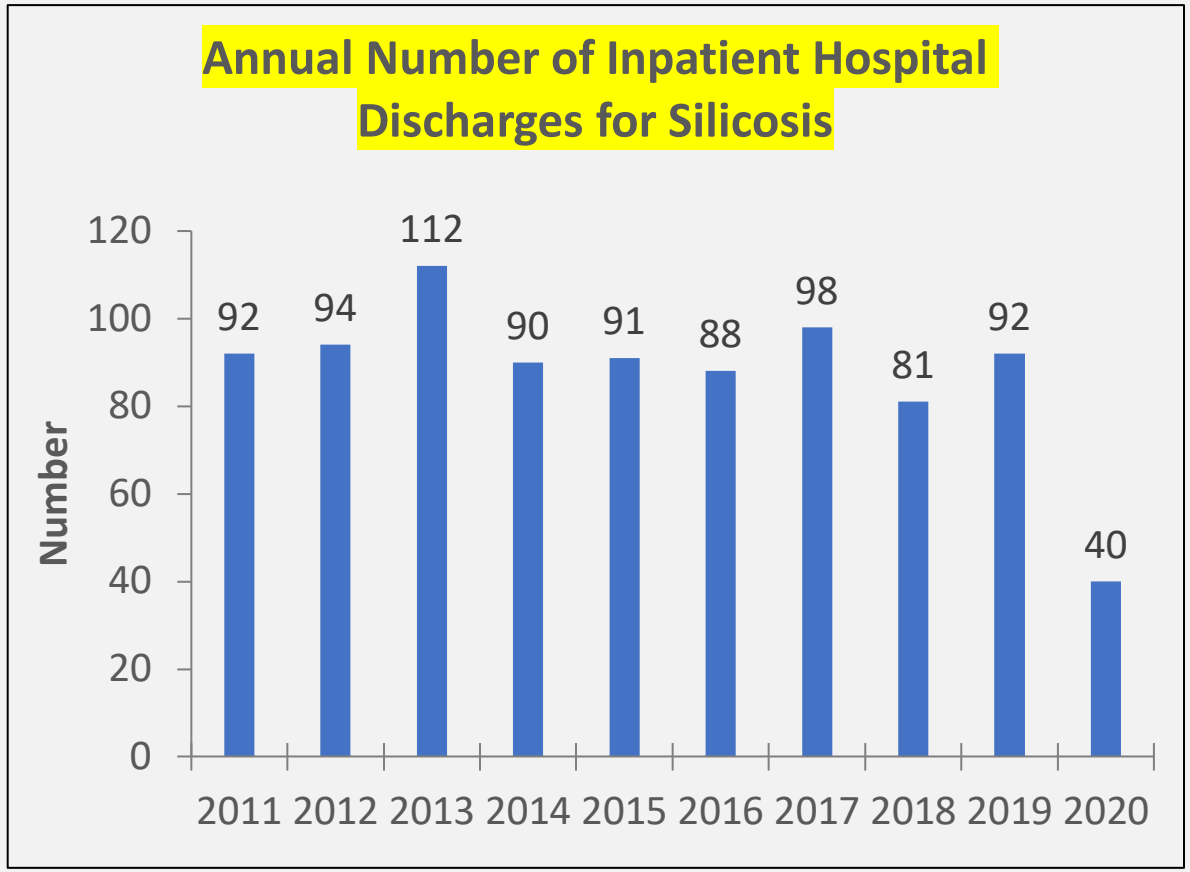
Silicosis Related Deaths in Texas, 2011-2020

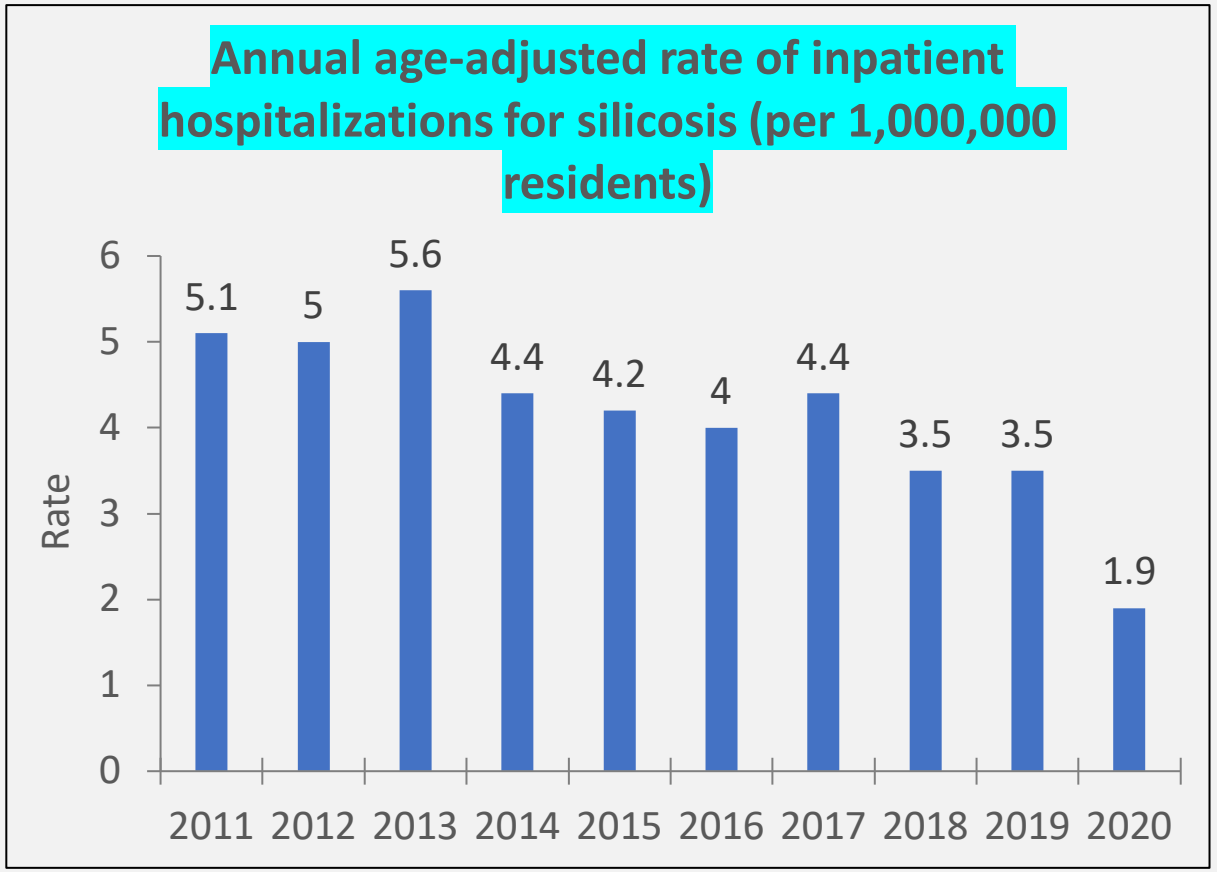




Data Sources/methods: Death certificate records for years 2011-2020 from Texas Vital Statistics were used to obtain number of silicosis deaths. State population estimates from the U.S. Bureau of the Census and year 2000 U.S. Standard Population were used as denominators for calculating age-adjusted death rate.

Silicosis Related Hospitalizations in Texas, 2011-2020



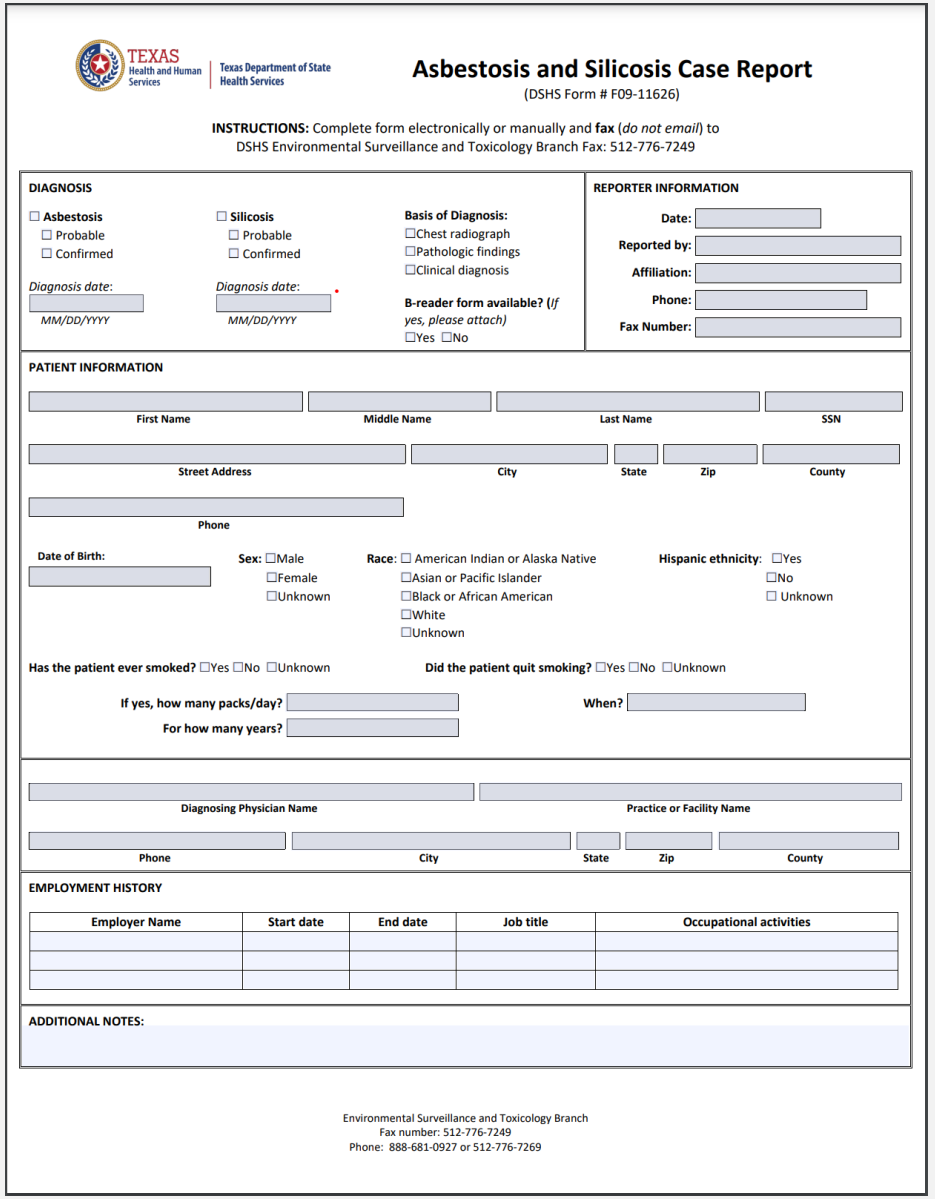


Data sources/methods: The public use data file for inpatient hospital discharges for years 2011-2019 from the Texas Health Care Information Collection (THCIC) was used to obtain number of silicosis inpatient hospitalizations. State population estimates from the U.S. Bureau of the Census and year 2000 U.S. Standard Population were used as denominators for calculating age-adjusted inpatient hospitalization rates.

Silicosis Case Reporting to DSHS

Who shall report confirmed or suspected cases*:

- A physician or health professional holding license to practice in the state of Texas, who diagnoses or treats the individual with the condition
- A person who is in charge of clinical or hospital laboratory, blood bank, mobile unit, or other facility in which a laboratory examination of any specimen derived from human body yield microscopical, cultural, serological, chemical or other evidence suggestive of the reportable condition.



TEXAS Health and Human Services | Texas Department of State Health Services

Asbestosis and Silicosis Case Report
(DSHS Form # F09-11626)

INSTRUCTIONS: Complete form electronically or manually and **fax** (*do not email*) to DSHS Environmental Surveillance and Toxicology Branch Fax: 512-776-7249

DIAGNOSIS

☐ **Asbestosis** ☐ Probable ☐ Confirmed — *Diagnosis date:* MM/DD/YYYY

☐ **Silicosis** ☐ Probable ☐ Confirmed — *Diagnosis date:* MM/DD/YYYY

Basis of Diagnosis: ☐Chest radiograph ☐Pathologic findings ☐Clinical diagnosis

B-reader form available? (*If yes, please attach*) ☐Yes ☐No

REPORTER INFORMATION

Date: | Reported by: | Affiliation: | Phone: | Fax Number:

PATIENT INFORMATION

First Name | Middle Name | Last Name | SSN

Street Address | City | State | Zip | County

Phone

Date of Birth:

Sex: ☐Male ☐Female ☐Unknown

Race: ☐ American Indian or Alaska Native ☐Asian or Pacific Islander ☐Black or African American ☐White ☐Unknown

Hispanic ethnicity: ☐Yes ☐No ☐ Unknown

Has the patient ever smoked? ☐Yes ☐No ☐Unknown **Did the patient quit smoking?** ☐Yes ☐No ☐Unknown

If yes, how many packs/day? When?

For how many years?

Diagnosing Physician Name | Practice or Facility Name

Phone | City | State | Zip | County

EMPLOYMENT HISTORY

Employer Name	Start date	End date	Job title	Occupational activities

ADDITIONAL NOTES:

Environmental Surveillance and Toxicology Branch
Fax number: 512-776-7249
Phone: 888-681-0927 or 512-776-7269

*https://texreg.sos.state.tx.us/public/readtac$ext.TacPage?sl=R&app=9&p_dir=&p_rloc=&p_tloc=&p_ploc=&pg=1&p_tac=&ti=25&pt=1&ch=99&rl=1

Image source: https://www.dshs.texas.gov/sites/default/files/CHI-ESTB/CaseReportForm-F09-11626.pdf

Silicosis Surveillance Case Definition

National Institute for Occupational Safety and Health (NIOSH) case definition for state-based surveillance of silicosis*:

- Individual with a history of occupational exposure to airborne silica dust

and either of the following:

- Evidence of silicosis on imaging (Chest X-ray or CT)
- Tissue biopsy characteristics of silicosis

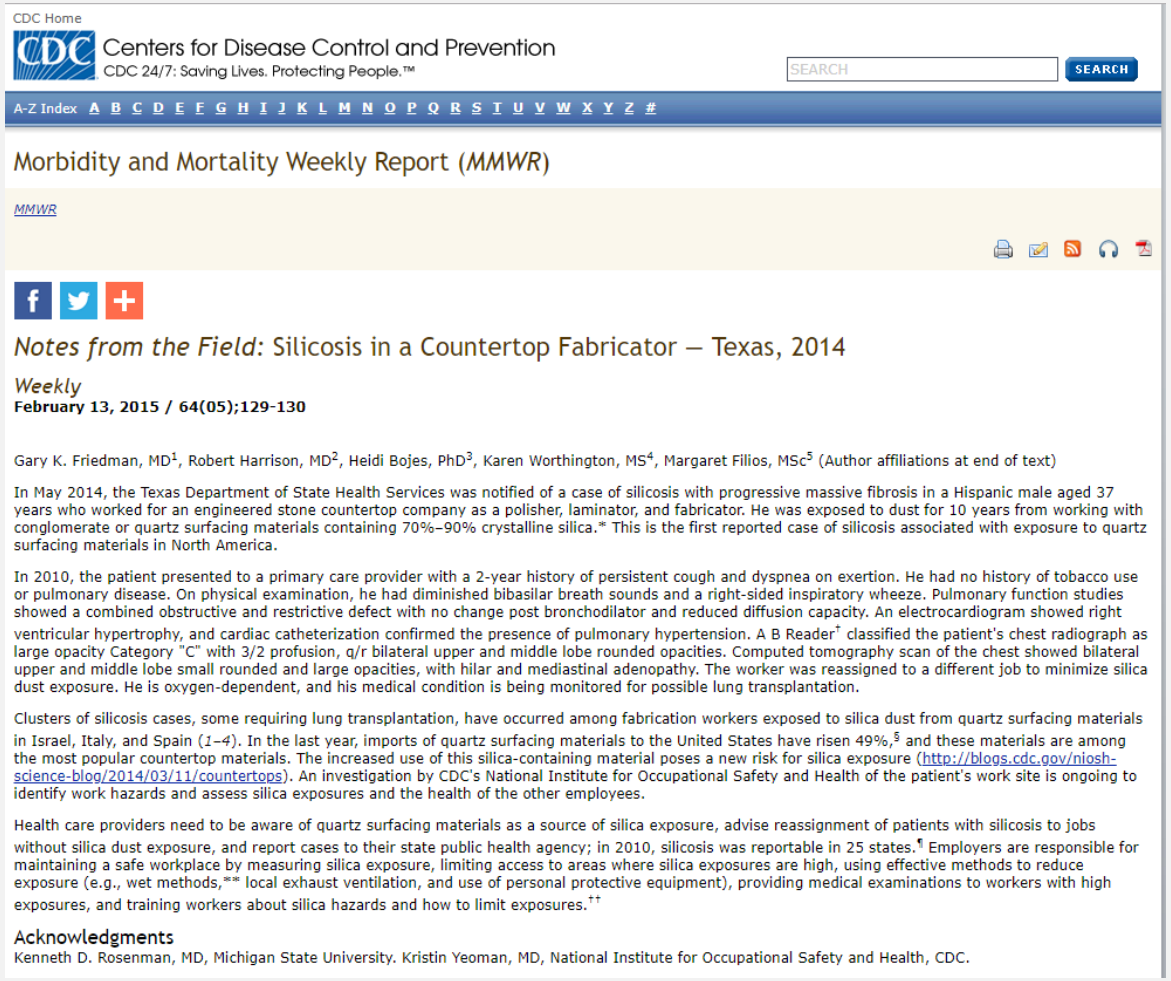
*NIOSH Silicosis State Reporting Guidelines https://www.cdc.gov/niosh/topics/surveillance/ords/statesurveillance/reportingguidelines-silicosis.html

Silicosis Associated with Artificial (Engineered) Stone

- In recent years, state-based occupational health surveillance programs have identified several cases silicosis and silicosis-related deaths among workers in engineered stone countertop manufacturing and fabrication in the U.S. [1]
- Researchers have found similar cases of silicosis in engineered stone workers globally, often with rapid progression of disease. [3-5]

1. Rose C, Heinzerling A, Patel K, et al. Severe Silicosis in Engineered Stone Fabrication Workers — California, Colorado, Texas, and Washington, 2017–2019. MMWR Morb Mortal Wkly Rep 2019;68:813–818. DOI: http://dx.doi.org/10.15585/mmwr.mm6838a1
2. Hoy, R. F., Glass, D. C., Dimitriadis, C., Hansen, J., Hore-Lacy, F., & Sim, M. R. (2021). Identification of early-stage silicosis through health screening of stone benchtop industry workers in Victoria, Australia. *Occupational and environmental medicine*, *78*(4), 296-302.
3. León-Jiménez, A., Hidalgo-Molina, A., Conde-Sánchez, M. Á., Pérez-Alonso, A., Morales-Morales, J. M., García-Gámez, E. M., & Córdoba-Doña, J. A. (2020). Artificial stone silicosis: rapid progression following exposure cessation. *Chest*, *158*(3), 1060-1068.
4. Leso, V., Fontana, L., Romano, R., Gervetti, P., & Iavicoli, I. (2019). Artificial stone associated silicosis: a systematic review. *International journal of environmental research and public health*, *16*(4), 568.
5. Hoy, R. F., Baird, T., Hammerschlag, G., Hart, D., Johnson, A. R., King, P., ... & Yates, D. H. (2018). Artificial stone-associated silicosis: a rapidly emerging occupational lung disease. *Occupational and environmental medicine*, *75*(1), 3-5.

Silicosis Associated with Engineered Stone Countertop Fabrication in the U.S.



CDC Home

Centers for Disease Control and Prevention
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SEARCH

A-Z Index A B C D E F G H I J K L M N O P Q R S T U V W X Y Z #

Morbidity and Mortality Weekly Report (*MMWR*)

MMWR

Notes from the Field: Silicosis in a Countertop Fabricator — Texas, 2014

Weekly
February 13, 2015 / 64(05);129-130

Gary K. Friedman, MD[1], Robert Harrison, MD[2], Heidi Bojes, PhD[3], Karen Worthington, MS[4], Margaret Filios, MSc[5] (Author affiliations at end of text)

In May 2014, the Texas Department of State Health Services was notified of a case of silicosis with progressive massive fibrosis in a Hispanic male aged 37 years who worked for an engineered stone countertop company as a polisher, laminator, and fabricator. He was exposed to dust for 10 years from working with conglomerate or quartz surfacing materials containing 70%–90% crystalline silica.* This is the first reported case of silicosis associated with exposure to quartz surfacing materials in North America.

In 2010, the patient presented to a primary care provider with a 2-year history of persistent cough and dyspnea on exertion. He had no history of tobacco use or pulmonary disease. On physical examination, he had diminished bibasilar breath sounds and a right-sided inspiratory wheeze. Pulmonary function studies showed a combined obstructive and restrictive defect with no change post bronchodilator and reduced diffusion capacity. An electrocardiogram showed right ventricular hypertrophy, and cardiac catheterization confirmed the presence of pulmonary hypertension. A B Reader† classified the patient's chest radiograph as large opacity Category "C" with 3/2 profusion, q/r bilateral upper and middle lobe rounded opacities. Computed tomography scan of the chest showed bilateral upper and middle lobe small rounded and large opacities, with hilar and mediastinal adenopathy. The worker was reassigned to a different job to minimize silica dust exposure. He is oxygen-dependent, and his medical condition is being monitored for possible lung transplantation.

Clusters of silicosis cases, some requiring lung transplantation, have occurred among fabrication workers exposed to silica dust from quartz surfacing materials in Israel, Italy, and Spain (*1–4*). In the last year, imports of quartz surfacing materials to the United States have risen 49%,§ and these materials are among the most popular countertop materials. The increased use of this silica-containing material poses a new risk for silica exposure (http://blogs.cdc.gov/niosh-science-blog/2014/03/11/countertops). An investigation by CDC's National Institute for Occupational Safety and Health of the patient's work site is ongoing to identify work hazards and assess silica exposures and the health of the other employees.

Health care providers need to be aware of quartz surfacing materials as a source of silica exposure, advise reassignment of patients with silicosis to jobs without silica dust exposure, and report cases to their state public health agency; in 2010, silicosis was reportable in 25 states.¶ Employers are responsible for maintaining a safe workplace by measuring silica exposure, limiting access to areas where silica exposures are high, using effective methods to reduce exposure (e.g., wet methods,** local exhaust ventilation, and use of personal protective equipment), providing medical examinations to workers with high exposures, and training workers about silica hazards and how to limit exposures.††

Acknowledgments
Kenneth D. Rosenman, MD, Michigan State University. Kristin Yeoman, MD, National Institute for Occupational Safety and Health, CDC.

https://www.cdc.gov/mmwr/preview/mmwrhtml/mm6405a5.htm

First Reported Cluster of Silicosis Associated with Engineered Stone Countertop Fabrication in U.S.

- DSHS OHS Program received **reports of 12 cases of silicosis from March 12 to April 9, 2019**
- Follow-up investigation and additional data gathering:
  - Review of medical records and imaging reports
  - Telephone interviews with the diagnosing and reporting physician
  - Review of company website and publicly available information on products and work processes
  - Review of any ongoing or completed OSHA investigations for the company

Texas Silicosis Cluster, 2019 –Summary

All 12 cases reported work-related exposure to silica dust

- Worked at the facility for a median of 6 years (range= 1-30 years)
- Worked as:
  - Fabricators (5, 42%)
  - Casting and molding engineered stone slabs (5, 33%)
  - Maintenance technicians (2, 17%)
- Eight (66%) of the cases reported exposures to phthalic anhydride and 5 (42%) reported exposures to epoxy resins used in countertops manufacturing at the facility.

Texas Silicosis Cluster, 2019 – Summary

Case demographics

- All 12 cases were males
- Median age at the time of diagnosis: 54.5 years (range=33-60 years)
- Race/ethnicity:
  - Hispanic or Latino= 6 (50%)
  - Non-Hispanic White= 4 (33%)
  - Non-Hispanic Black or African American= 2 (17%)

Texas Silicosis Cluster, 2019 - Summary

Reported Signs/symptoms

- Cough (5, 42%)
- Wheezing (3, 25%)
- Shortness of breath at rest or exertion (2, 17%)

Lung function test (spirometry)

All 12 cases showed a mix of moderately obstructive and restrictive lung function

Other medical findings

- Four (33%) had a diagnosis of occupational asthma
- None tested positive for tuberculosis (Purified Protein Derivative (PPD) skin test)

Texas Silicosis Cluster, 2019- Summary

All 12 cases had a positive B-read on chest X-rays

Chest X-ray findings	Count (%)
Small opacities in both lungs[†]	12 (100)
Small opacities: shape and size	
Irregular shape, width up to 1.5 mm (s/s)	6 (50)
Irregular shape, width 1.5 mm to 3 mm (s/t)	4 (33)
Irregular and round shapes, width and diameter up to 1.5 mm (s/p)	2 (17)
Small opacities: ILO Profusion[§]	
1/0	4 (33)
1/1	3 (25)
1/2	2 (17)
2/1	2 (17)
2/2	1 (8)
Large opacities[¶]	0

- [†] The letters denote the shape and size of small opacities in lungs visible on a chest X-ray B-read. Irregular opacities are classified by width and rounded opacities are classified by diameter.
- [§]Profusion is based on the assessment of the concentration of opacities by comparison with a standard radiograph.
- [¶]Large opacities are defined as any opacity greater than 1 cm on a chest X-ray B-read.

- Note: A "B" reader is a physician or radiologist certified by the National Institute for Occupational Safety and Health, Center for Disease Control and Prevention on demonstrating proficiency to classify radiographs of pneumoconiosis as per ILO guidelines. Additional information available at https://www.cdc.gov/niosh/topics/chestradiography/ilo.html and https://www.cdc.gov/niosh/topics/chestradiography/breader.html.

Texas Silicosis Cluster, 2019: Health Advisory

HEALTH ADVISORY

March 18, 2019

HEALTH ADVISORY

Worker exposure to silica dust during stone countertop fabrication
March 18, 2019

Situation Overview

In March 2019, the Texas Department of State Health Services (DSHS) received a report of an apparent cluster of multiple cases of silicosis among workers associated with occupational silica dust exposures that occurred during the manufacture, finishing, and installation of stone countertops. DSHS is currently investigating these cases. There are no reported silica exposures to consumers from countertops in their homes.

Silicosis is an incurable, disabling, and often-fatal lung disease caused by inhalation of very fine particles of crystalline silica dust over a long period of time, which primarily occurs in workplace settings.

https://www.dshs.texas.gov/news-alerts/silica-health-advisory-03-18-19#:~:text=Situation%20Overview,and%20installation%20of%20stone%20countertops.

Peer-Reviewed Journal Publication for Silicosis Cluster Investigation

Centers for Disease Control and Prevention

MMWR

Morbidity and Mortality Weekly Report

Weekly / Vol. 68 / No. 38

September 27, 2019

Severe Silicosis in Engineered Stone Fabrication Workers — California, Colorado, Texas, and Washington, 2017–2019

Cecile Rose, MD[1,2*]; Amy Heinzerling, MD[3,4*]; Ketki Patel, MD, PhD[5]; Coralynn Sack, MD[6,7]; Jenna Wolff[1]; Lauren Zell-Baran, MPH[1,8]; David Weissman, MD[9]; Emily Hall, MPH[5]; Robbie Sooriash, MD[5]; Ronda B. McCarthy, MD[10]; Heidi Bojes, PhD[5]; Brian Korotzer, MD[11]; Jennifer Flattery, MPH[3]; Justine Lew Weinberg, MSEHS[3,12]; Joshua Potocko, MD[13]; Kirk D. Jones, MD[14]; Carolyn K. Reeb-Whitaker, MS[15]; Nicholas K. Reul, MD[6,7,16]; Claire R. LaSee, MPH, MSW[15]; Barbara L. Materna, PhD[3]; Ganesh Raghu, MD[6]; Robert Harrison, MD[3]

https://www.cdc.gov/mmwr/volumes/68/wr/pdfs/mm6838a1-H.pdf

NIOSH Health Hazard Evaluations

- “Provides authoritative assistance in evaluating new and recurring workplace health hazards”
- “Raise awareness of new and recurring workplace health hazards and preventive measures based on health hazard evaluation findings”

Source: https://www.cdc.gov/niosh/hhe/default.html

Texas Silicosis Cluster, 2019- HHE Timeline

April 2019

DSHS requested technical assistance from NIOSH for a Health Hazard Evaluation (HHE)

November 2021

NIOSH Lead Industrial Hygienist conducted a walkthrough site visit of company's facility

February 2024

NIOSH HHE team provided a close out letter to DSHS and the company summarizing HHE findings and recommendations.

Note: From April 2019 through May 2023, NIOSH requested and reviewed multiple documents provided by the company ranging from medical surveillance information, worker employment records, job tasks, work processes, and air sampling measurements for respirable crystalline silica (Oct 2021 – May 2023) and phthalic anhydride (Feb 2023 – May 2023).

Texas Silicosis Cluster, 2019- HHE Conclusions

NIOSH review of quarterly air sampling results provided by the company.

Results showed control measures had reduced employee' exposures to respirable crystalline silica and phthalic anhydride.

Despite using wet processes and exhaust ventilation, air sampling results revealed that respirable crystalline silica exposures were:

- Still above the OSHA action level* at times, and
- Above the OSHA PEL** when dry sanding was done.

*OSHA Action Level= 0.025 milligrams per cubic meter of air.
**OSHA Permissible Exposure Limit (PEL)= 0.05 milligrams per cubic meter of air.

Texas Silicosis Cluster, 2019- HHE Conclusions

- Quarterly air sampling results showed that phthalic anhydride exposures were:
  - Reduced to below the OSHA PEL* but
  - Above the NIOSH REL** at times, and
  - All exposures were above the ACGIH TLV***

*OSHA Permissible Exposure Limit (PEL)= 12 milligrams per cubic meter of air.
**NIOSH Recommended Exposure Limit (REL) = 6 milligrams per cubic meter of air.
***American Conference of Government Industrial Hygienists (ACGIH) Threshold Limit Value (TLV) = 0.002 milligrams per cubic meter of air.

Texas Silicosis Cluster, 2019- HHE Conclusions

NIOSH did not have individual spirometry results and to complete a thorough assessment of the respiratory health of the workforce.

NIOSH recommended:

1. Ongoing improvements in ventilation to reduce employees' exposures,
2. Utilizing medical surveillance for employees exposed to respirable crystalline silica and phthalic anhydride,
3. Proper use of respiratory protection, and
4. Continuing to conduct periodic exposure assessment.

Challenges in State-based Surveillance and Prevention

- Diverse workforce, rapidly evolving work processes, work organization (non-standard work arrangements, contingent workers)
- Underreporting/ under recording
- Access to quality data
- Limited exposure and health outcomes data
- Hard-to-reach worker populations
- Cultural and language barriers
- Resources

Image source: http://edwinmoindi.blogspot.com/2014/08/the-falacy-that-is-public-education-are.html

Road Forward: Opportunities for Surveillance, Research and Prevention

- Strategic partnerships
- Capacity building
- Improving state and national-level surveillance for silicosis as well as other occupational respiratory diseases
- Innovative methods for educational interventions:
  - Use of digital and social media
  - Targeted outreach to health care providers, employers and businesses, and worker populations

Thank you!

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Texas Department of State Health Services

Environmental Surveillance and Toxicology Branch

https://www.dshs.texas.gov/environmental-surveillance-toxicology