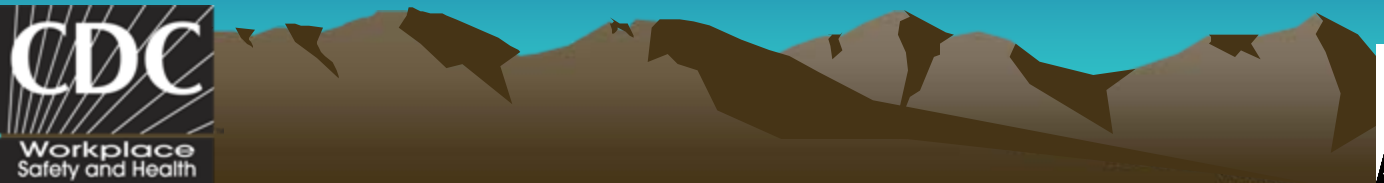
Global and Regional Overview Silicosis Elimination

Marilyn Fingerhut and Faye Rice
NIOSH

PAHO Session
XVIII World Congress on Safety and Health at Work
Seoul, Korea July, 2008



Outline of Presentation

- Silicosis
- Sources of Exposure
- Magnitude of the problem
- ILO/WHO Global Program to Eliminate Silicosis
- Americas Regional initiative to Eliminate Silicosis
- Conclusion

Forms of Silicosis

- **Chronic**: after >10 years of exposure
- **Accelerated**: 5-10 years from 1st exposure; rapid progression; may not be on chest radiograph
- **Acute**: symptoms within weeks to 5 yrs.; high concentrations; fibrosis may not be present

(Source: ISP brochure)

Silicosis: Most frequently recorded industries on death certificate, U.S. residents age 15 and over, selected states and years, 1990-1999

CIC	Industry	Number of Deaths	Percent
060	Construction	118	13.4
040	Metal mining	86	9.8
041	Coal mining	69	7.8
270	Blast furnaces, steelworks, rolling and finishing mills	51	5.8
050	Nonmetallic mining and quarrying, except fuel	48	5.5
271	Iron and steel foundries	48	5.5
262	Miscellaneous nonmetallic mineral and stone products	44	5.0
392	Not specified manufacturing industries	33	3.8
331	Machinery, except electrical, n.e.c.	23	2.6
252	Structural clay products	20	2.3
	All other industries	317	36.0
	Industry not reported	23	2.6
	TOTAL	**880**	**100.0**

CIC = Census Industry Code

Sources: National Center for Health Statistics multiple cause of death data. NIOSH e-WoRLD Table 3-6 (May 2003): http://www2a.cdc.gov/drds/WorldReportData/SectionDetails.asp?SectionTitleID=3

Can exceed 8-hr limits in a few minutes of exposure

- Observed Concentration: **14 mg/m^3** respirable quartz
- Time to exceed 0.05 mg/m^3 8-hr TWA: **1.7 min.**

Photo: Ken Linch, NIOSH Source: Linch KD [2002]. Appl Occup Environ Hyg

Direct Causal Relationship

Occup. Resp. Cryst. Silica → **(causes)** → Silicosis

A Preventable Disease!

What is the size of the problem?

- Many millions of workers around the world continue to be exposed to silica dust.

- Recognition and reporting are poor in many countries, leading to grave underestimation of the problem.

Indications of the magnitude of the problem in India (1)

- **68%** of former stone crusher mill workers in Lal Kuan had silicosis, silico-tuberculosis or tuberculosis

- Road building has generated more than 12,000 stone crushing units employing 500,000 workers, and in many cases families

Sources: WHO 2000 Fact Sheet; Gottesfeld P IJOEH 2008, 14:94-103

Indications of the magnitude of the problem in India (2)

- Silicotic pencil workers in Central India had a mean age at death of 35 years and a mean duration of exposure of 12 years

- Nearly 50% of the workers who made silica powder from quartz stone had radiographic signs of silicosis or tuberculosis in a study of ex-silica mill workers
  - 90% of these workers had worked less than five years

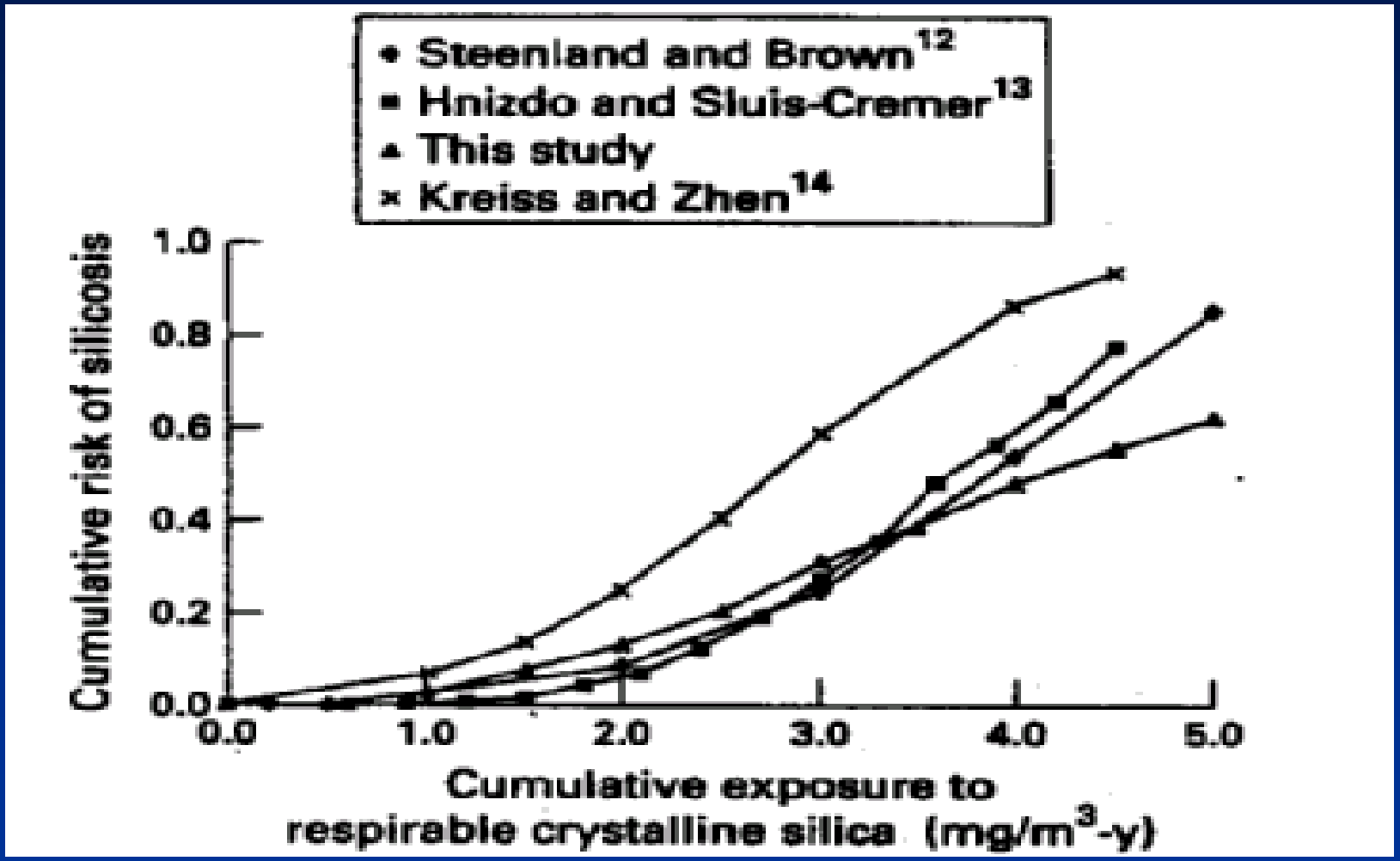
Sources: WHO 2000 Fact Sheet; Bhagia L GOHNET 12: 12-15, 2007

Magnitude of the Problem in the Americas Region

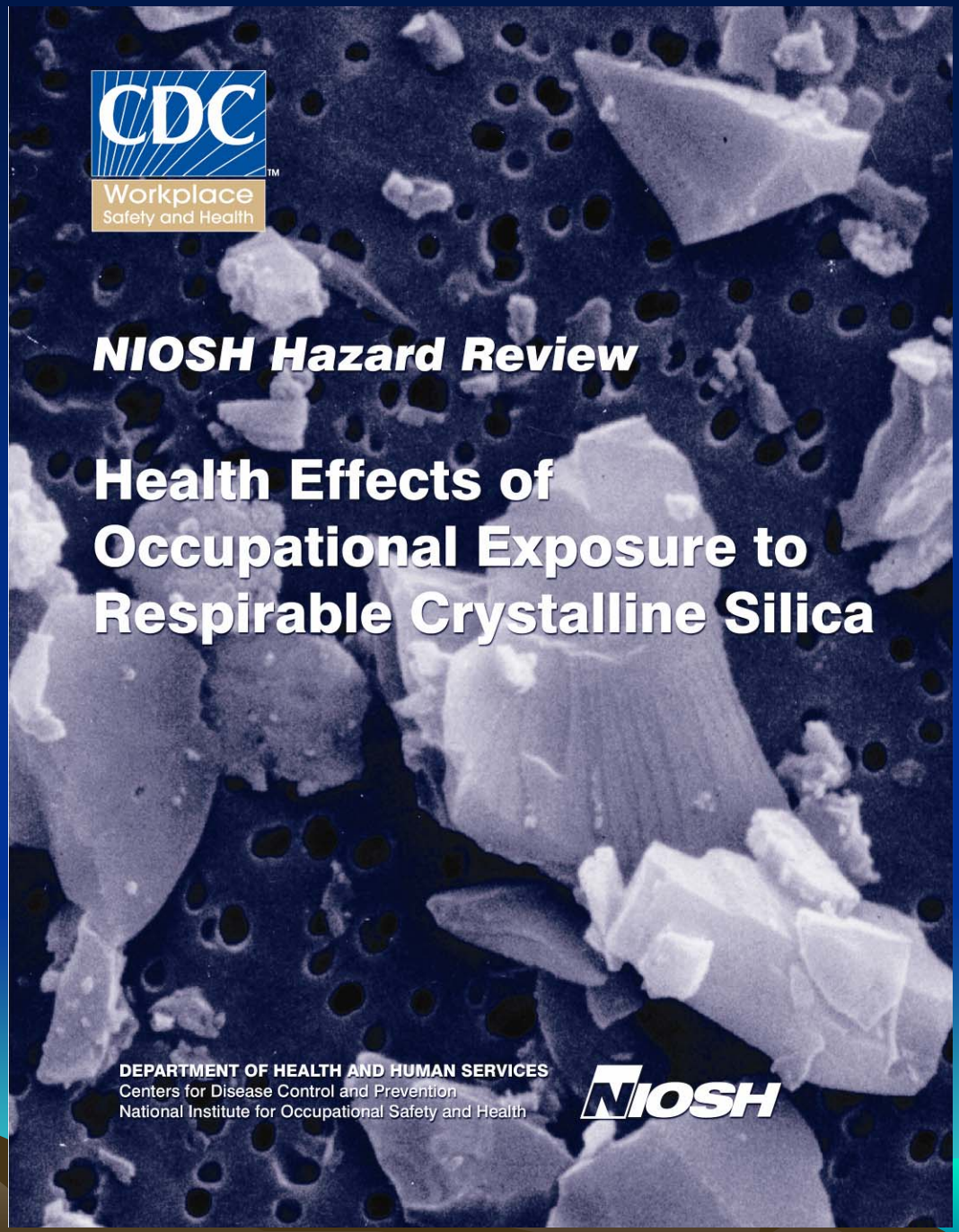
- In the United States, at least 1.7 million workers are exposed
- The Colombian Government estimates that 1.8 million workers in the country are at risk of developing the disease
- In Chile, about 5.4 % of the workforce in the formal and informal sectors has a high probability of exposure to silica
- In Brazil, about 2 million workers in the formal sector are exposed to silica for as long as 30% of their working hours

Sources: WHO 2000 Fact Sheet; CDC E-Brief 2007; Bernales B et al Ciencia y Trabajo 27: 1-6 2008; Algranti E GOHNET 2007, 12:15-17.

Risk of silicosis: exposure-response curve



Source: Chen et al. 2001 Occup Environ Med tin miners in China


CDC
Workplace
Safety and Health
NIOSH Hazard Review
Health Effects of Occupational Exposure to Respirable Crystalline Silica
DEPARTMENT OF HEALTH AND HUMAN SERVICES
Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health
NIOSH

Conclusions: Many health effects are caused by silica exposure

- Occupational exposure to respirable crystalline silica is associated with:
  - **Silicosis**
  - **Lung cancer**
  - **Airways diseases (i.e., bronchitis, emphysema, COPD)**
  - **Mycobacterial and Fungal Infections** (e.g., Pulmonary tuberculosis (TB)
  - Other, including autoimmune disorders and chronic renal disease

Source: NIOSH Hazard Review [2002]

The ILO/WHO Global Program to Eliminate Silicosis

ILO/WHO Global Program to Eliminate Silicosis (1995)

- Components required of the Country
  - Establishing a National Plan to Eliminate Silicosis
    - Primary Prevention by controlling sources of exposure
    - Secondary Prevention by surveillance, detection, healthcare
  - Creating an Action Plan involving relevant ministries and partners in the private sector
  - Developing a National Silicosis Profile

ILO/WHO Global Program to Eliminate Silicosis (1995)

Countries with National Plans

- Brazil
- Chile
- China
- India
- Thailand
- Vietnam
- South Africa

The Americas Regional Initiative to Eliminate Silicosis (2005)

- WHO, PAHO, ILO
  - U.S. National Institute for Occupational Safety and Health (NIOSH)
  - Chile Institute of Public Health and Ministry of Health
  - Brazil FUNDACENTRO
  - Peru CENSOPAS
  - Other countries joining: Mexico, Uruguay, Argentina, etc

Americas Initiative Components

1. Implementation of control methodology
2. Laboratory Analytical Techniques
3. Respiratory Protection Training
4. Silicosis Surveillance Systems
5. Training courses on spirometry and on radiologic reading using the ILO technique

Photos: A. Sussell, NIOSH (left)
NIOSH DRDS (right)

Controlling Exposures in the Americas Initiative to Eliminate Silicosis

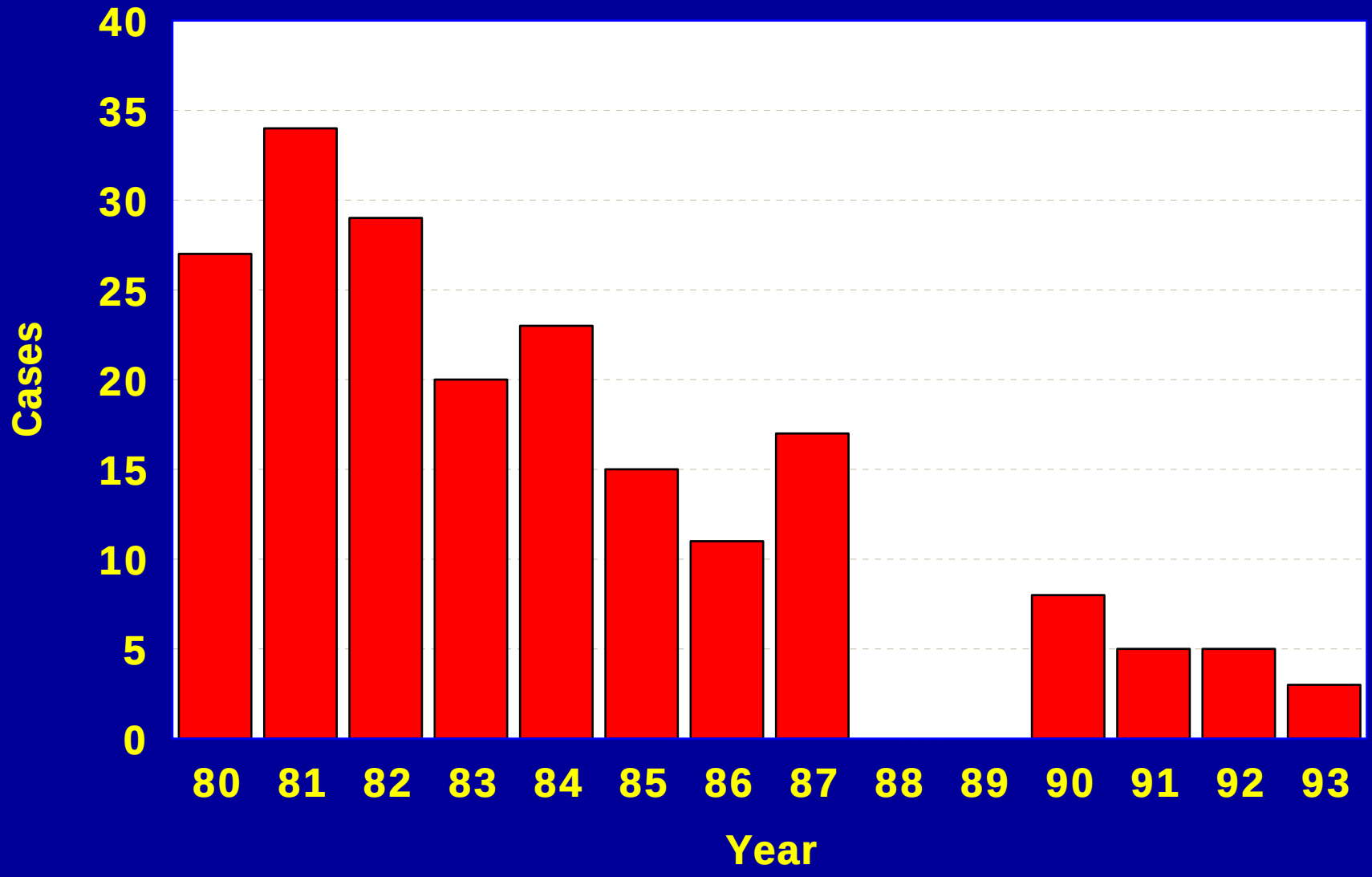
- Development of simple guidance for employers to put controls in place to reduce silica exposures
- This qualitative risk assessment approach is also called Control Banding
  - Training of participants from Chile, Peru, Brazil and Uruguay in methods of dust control
  - Field visits to underground copper mine, small quarries, stone crushing and stone craft worksites
  - Developing by local experts of customized guidance sheets suitable for use in Chile small businesses

Do intervention efforts work?

Yes!

Sweden

Reported Cases of Silicosis



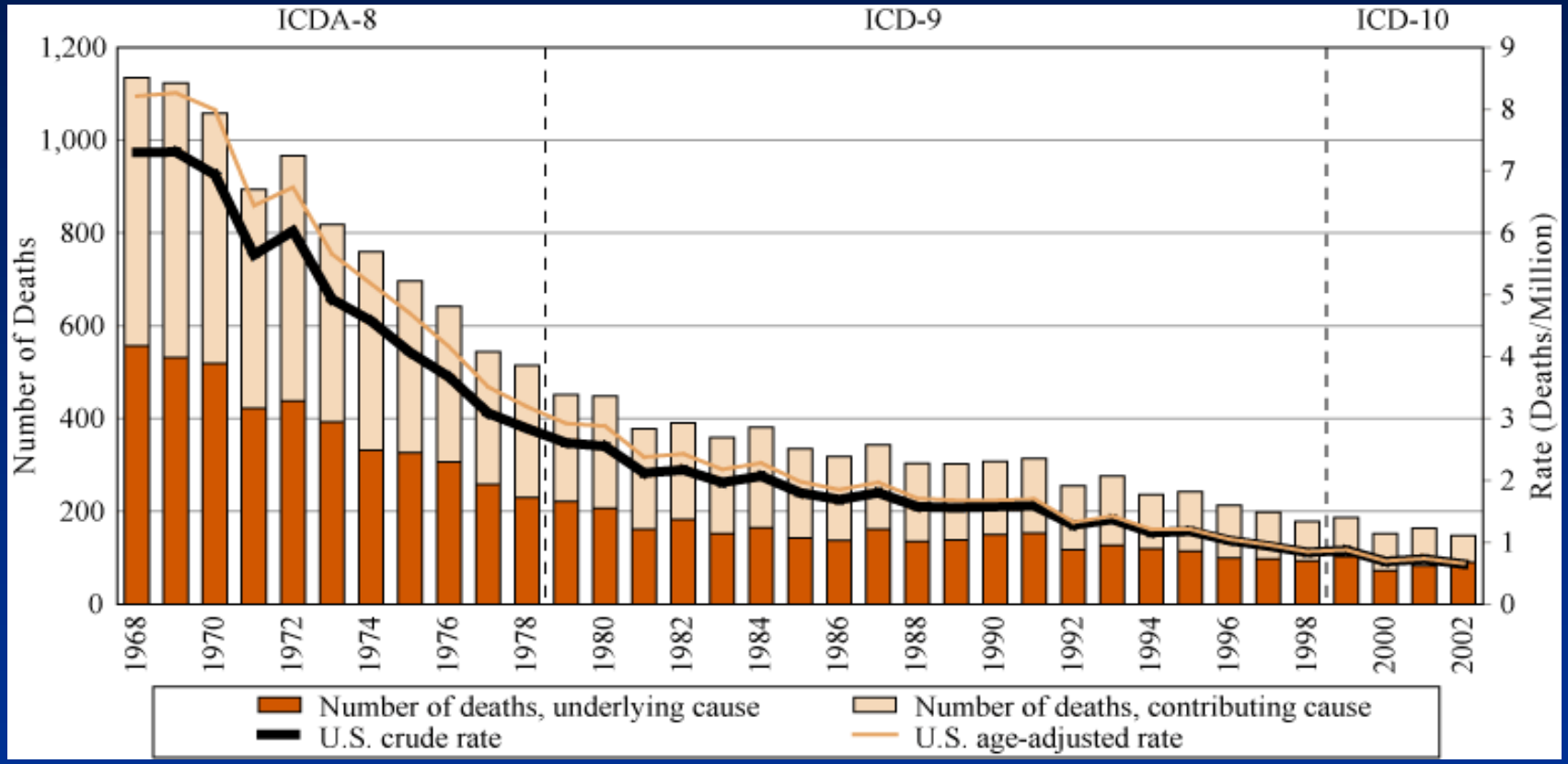
Source: ISA

Sweden: Factors

- Social conditions in country
- Shortage of labor took workers to other jobs
- Support by local trade unions for prevention
- Concern of general public
- Medical and IH professionals involved and supported

More information: Gerhardsson G [2002]; Malmberg P [2005] in *OSH & Development*

United States: Number of silicosis deaths, crude and age-adjusted death rates, U.S. residents age 15 and over, 1968–2002.



Sources: NIOSH eWorld (Fig. Ref.No. 2005F03-01);
National Center for Health Statistics multiple cause-of-death data.
Population estimates from U.S. Bureau of the Census.
http://www2a.cdc.gov/drds/WorldReportData/SubsectionDetails.asp?SubsectionTitleID=8

Silicosis Mortality Decline in U.S. 1968–2002

- Implementation of national standards in 1970s
- Ancillary prevention (e.g., respiratory protection)
- Declining employment in heavy industries (e.g., mining)
- However, U.S. “silica overexposure remains widespread”
  - Surveillance and interventions are still needed

Source: CDC/NIOSH MMWR April 29, 2005
http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5416a2.htm

Economic Impact of Interventions at the Workplace

- Limited information about cost of interventions
- Engineering controls are most cost-effective:
  - Cost of $106-$109 per healthy year saved

Source: Lahiri et al. [2005] Am J Ind Med; WHO-funded study

What is needed to reduce exposures?

- Implementation and Evaluation of Control Banding (simple guidance for employers)

- Sharing Successful Methods to Control Exposures
  - Construction
  - Foundries
  - Abrasive Blasting
  - Surface & other mining
  - Paints, coatings, glass, ceramics, stone cutting, and dental laboratories

Summary

- Occupational exposure causes disease.
- Primary prevention is the optimum form of prevention.
- Silicosis and silica-related diseases are preventable.

- The ongoing partnership of the countries of the Americas with PAHO, WHO and ILO is a model for other countries and regions and is helping to meet the ILO/WHO goal to eliminate silicosis by 2030.

Thank you for your attention.

NIOSH