



UMC Utrecht

Nederlands Kenniscentrum Arbeid en Longaandoeningen

Vroege detectie van silicose in de keramische industrie

medische surveillance als initiator voor verdere preventie



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Introduction

Crystalline silica (quartz)

- **Respirable; OEL in NL: 0.075 mg/m³**

Health effects

- **Silicosis – (mixed dust) pneumoconiosis**
- **Lung cancer (IARC: class 1 carcinogenic agent)**
- **COPD (chronic bronchitis, emphysema)**
- **Tuberculosis**
- **(Reumatoid arthritis, auto-immune, renal disease)**



Silicosis

Diagnosis

- **difficult: no early symptoms, or similar to COPD**
- **work history (exposure) crucial**

Therapy

- **not available**

Prevention

- **early detection**
- **exposure measures only tool**

Raymond LW. ACOEM evidence-based statement. J Occ Environ Med 2006; 48: 95-101



Prevalence of silicosis

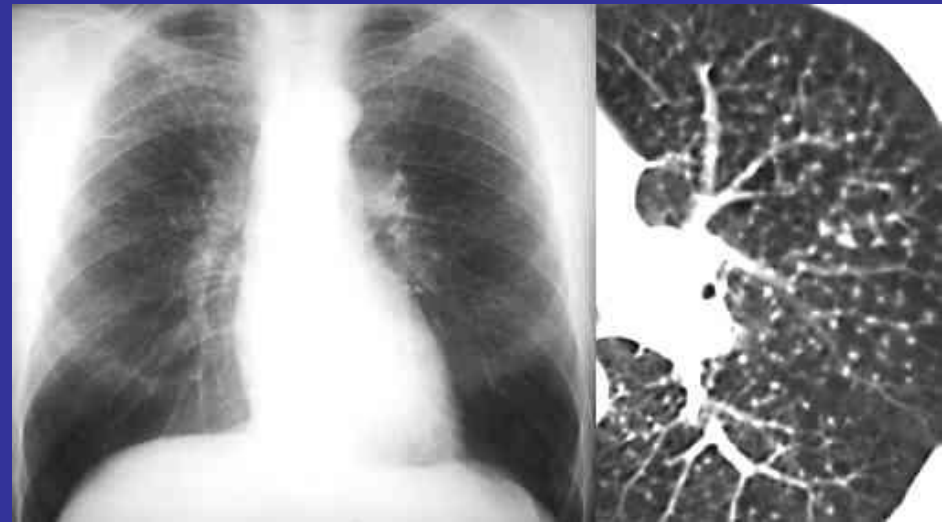
- Foreign studies still show high prevalences, even today:
 - o India: **flour mill, grinding stones: 30.4%**
Indian J Occup Environ Med 2011;15:104-8
 - o Turkey: **Sandblasting jeans: ≈50%**
Am J Resp Crit Care Med 2011;184:1322-1324
 - o Spain: **Cutting marble stones: 54.5%**
Arch Bronconeumol 2011;47:50-51
 - o South-Africa: **Gold mining: 22-36%**
Env Health Perspect 2010;118:421-426
 - o Brazil: **Stone polishing: >10%**
Int J Occup Environ Health 2010;16:147-150

- Importantly: high exposure levels in these industries



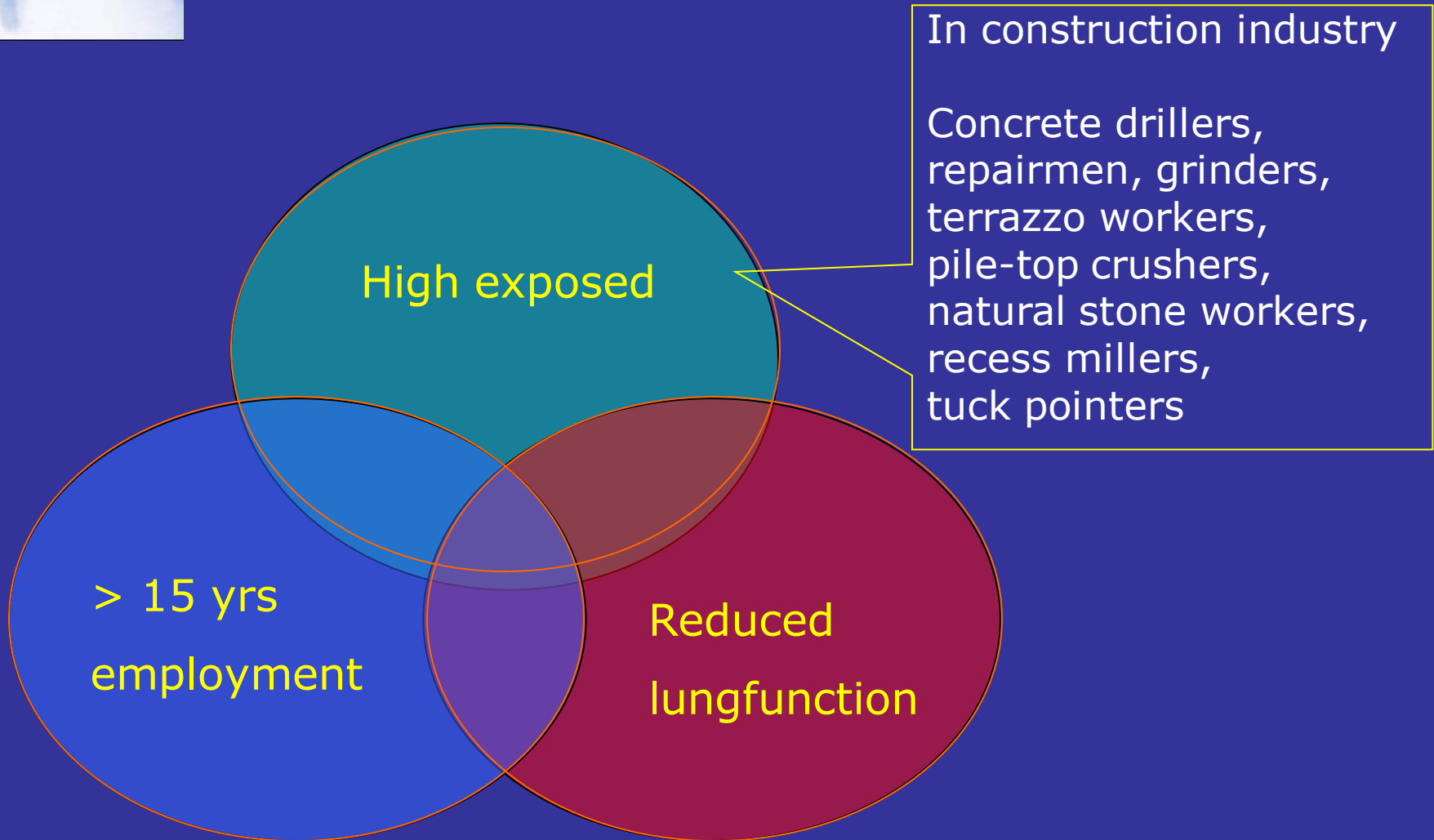
Prevalence of silicosis

- Exposure levels in NL generally lower
- Silicosis still existing in NL?
 - Pneumoconiose **2 meldingen/jaar** (NCvB: Beroepsziekten in cijfers 2011)
 - Research in construction industry in NL in 2009/2010:
 - Several cases of silicoses were found in 160 construction workers (high risk workers): '**search and you will find**'
 - Opinion ceramic industry: '**non-existing problem**'
- Currently more sensitive diagnostic methods available:
 - X-ray vs HRCT scan





Diagnostic model for silicosis strongest predictors



A simple diagnostic model for ruling out pneumoconiosis among construction workers

Eva Suarathana, Karel G M Moons, Dick Heederik and Evert Meijer

Occup. Environ. Med. 2007;64;595-601; originally published online 4 Apr 2007; doi:10.1136/oem.2006.027904

Modifications for ceramic industry

(both assigned same score of 1.5 in prediction rule):

1. Ever worked in high exposed job title (> 0.1 mg/m³)

2. ≥ 15 years worked in industry with quartz exposure (total job history)

Table 3 Diagnostic model for chest X-ray indicative for pneumoconiosis and the corresponding predicted probability

Variable in the model	Value	Score
Age	≥ 40 years	1.0
Smoking habit	Current smoker	1.0
High exposed job title	Concrete repairman, concrete blaster, concrete driller and grinder, terrazzo worker, pile-top crusher, natural stone worker, recess miller, tuck pointer chasing out mortar between bricks, rubble cleaner, recess cutter or demolition worker	1.5
Work duration in the construction industry	≥ 15 years	1.5
Self-rated health	'Feeling unhealthy'	1.25
Standardized residual FEV1	≤ -1.0	1.25
Sum score		...

Sum score	< 3	3	3.75	4.0	4.25	4.75	5.25	6.25	7.5
Predicted probability of outcome (%)	0	1	2	2.5	3	5	8	19	45



Ceramic industry

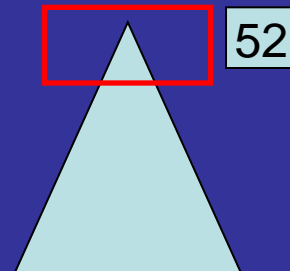
Phase 1: for all workers: N=353 (response 90%):

1. Questionnaire (symptoms, work history)
2. Basic spirometry
3. Application of diagnostic model

Phase 2: for workers with risk score ≥ 5 : N=48 (response 92%):

1. Full lung function research
2. Low-dose high resolution CT-scan of the lungs

Score	number
0	40
1	34
1.25	8
1.5	11
2	8
2.25	8
2.5	74
2.75	3
3	1
3.25	1
3.5	38
3.75	11
4	50
4.25	1
4.5	1
4.75	12
5	27
5.25	15
6.25	10





Results (N=48)

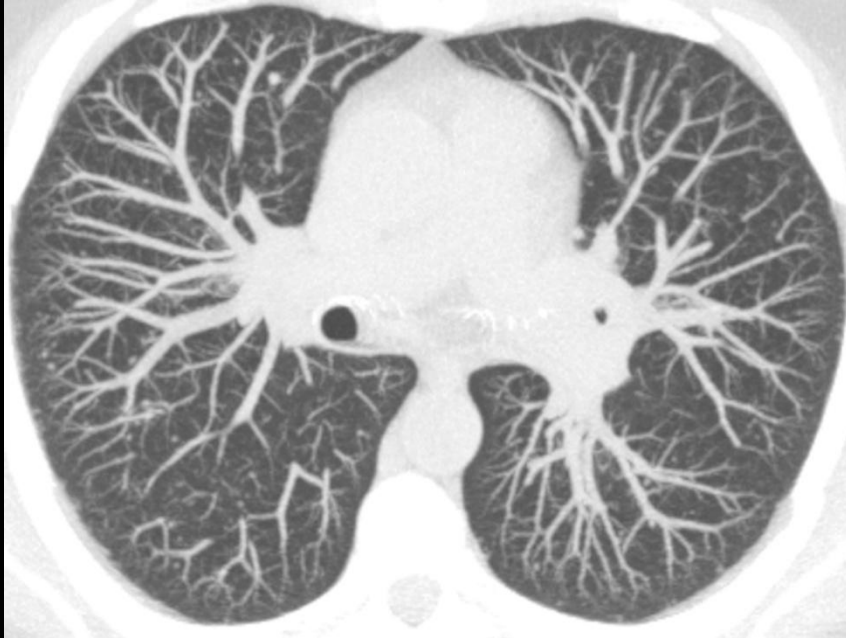
~~Opinion ceramic industry:
'non-existing problem'~~

	n	(%)	<u>N=353</u>
Silicosis	8	(17%)	(2.3%)
High number of micronodules (insufficient for silicosis)	3	(6%)	(0.8%)
COPD	6	(13%)	(1.7%)

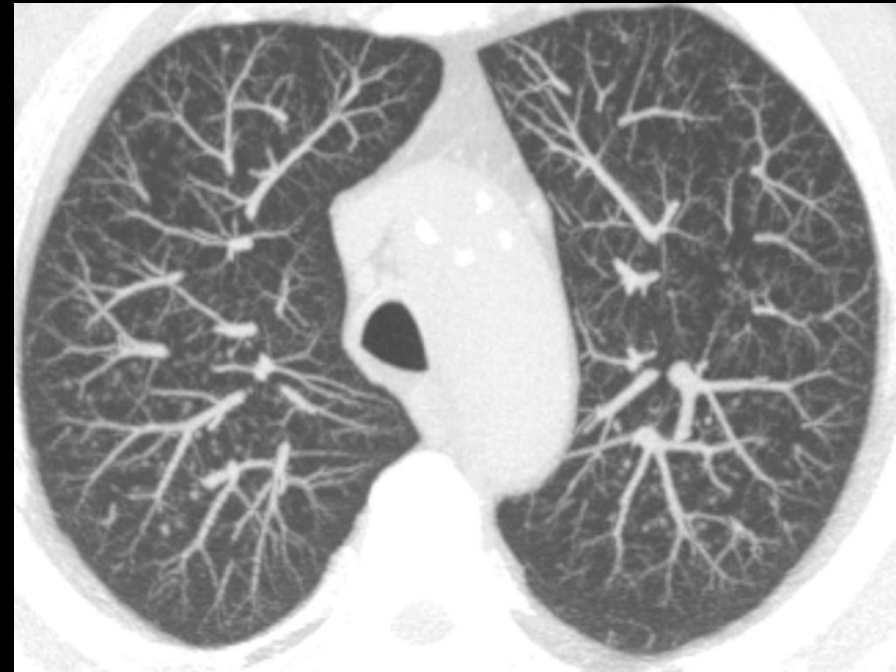
	n	(%)
COPD		
Gold I (one silicosis)	2	(4%)
Gold II	3	(6%)
Gold III	1	(2%)

Silicosis

male, 48 yrs, mixing and grinding ingredients, non-smoker, normal lung function



male, 61 yrs, forming area heavy ex-smoker (120 PY), normal lung function





Problem of the past?

- Exposure levels to quartz & dust decreased in last 15 yrs
- Silicosis still relevant at current exposure levels?
- Further reduction of quartz exposure levels was decided by management



Further actions to reduce quartz exposures

1. For workers diagnosed with silicosis
 - Clinic: no further exposure to quartz ($>$ OEL)
 - Individual guidance & follow-up
2. All processes and jobs with (potential) quartz exposure
 - Process analysis



Detailed inventory of all exposures (process/task)

1	A	B	C	D	E	F	G	H	I	J	K	L	M
2	Step	Process step	Process materials	Activities	Frequency	Duration	Moment of exposure	Agent	Exposure route	Intensity of exposure	Sampling information	Control measures	PPE
3	Part 1: Regular process												
4	R1												
5	R2												
6												
7	Part 2: regular maintenance and cleaning												
8	O1												
9	O2												
10												
11	Part 3: Process disturbances												
12	S1												
13	S2												
14												
15	Part 4: Lab & quality control												
16	LK1												
17	LK2												
18												

Don't forget these!!!!

Process step
Process materials
Activities

Frequency
Duration
Moment of exposure
Agent
Exposure route
Intensity of exposure (e.g. high/medium/low)
Sampling information
Control measures & PPE

[Link excel process analysis](#)
[Link excel job-task matrix](#)



Investment plan & control measures

- Structural investments to further reduce dust & quartz exposure levels:
 - Full support of management
 - More strict enclosures of processes to avoid leakage
 - Additional/improved ventilation at various points in process
 - More strict working methods (e.g. cleaning procedures)
 - Worker's education

- For individual workers with silicosis:
 - Avoidance of tasks with exposure potential



Silicosis

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Thanks to early detection:
Big step forward both on
1. individual level
2. Population level

Raymond LW. ACOEM evidence-based statement. J Occ Environ Med 2006; 48: 95-101



Conclusions

1. Silicosis in the Netherlands is still relevant in industries with quartz exposure, including ceramic industry
2. Diagnostic model as developed for construction industry can be applied to other industries
3. Silicosis screening appeared to be strong initiator of further exposure reductions & control measures

Benefit?

In the end workers gained a lot from the medical surveillance programme !



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