NVVA symposium 2010

Gezondheidsbewaking en medische triage voor silicose in de bouwnijverheid

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Nederlands Kenniscentrum Arbeid en Longaandoeningen

www.nkal.nl

UMC Utrecht

Division Heart & Lungs UMCU

IRAS/UU

Silicose?

- man, 52 jaar, in de bouw sinds 40 jaar
  30 jaar als timmerman, 10 als uitvoerder
- nooit gerookt
- geen pulmonale voorgeschiedenis
- sinds 6 maanden hoesten, dyspnoe d'effort

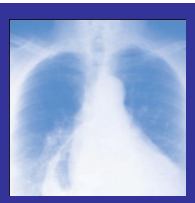
Blootstelling per beroep

Respirable dust (mg/m^3) and respirable quartz (mg/m^3) by construction workers sub-group

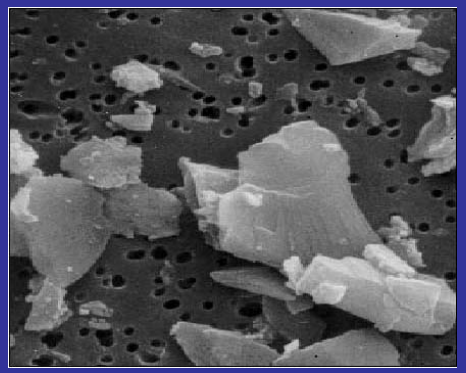
			Respirable dust (mg/m^3)	Respirable quartz (mg/m^3)
Group	N[1]	n[2]	AM min-max	AM min-max
Total	34	68	2.2 0.1-11.5	0.35 0.002-3.77
Voegenhakkers	4	10	3.5 0.6-8.0	0.56 0.089-1.65
Sleuvenfreezers/betonbo orders	8	14	2.8 0.2-11.5	0.84 0.028-3.77
Slopers	10	22	2.4 0.2-9.4	0.25 0.038-1.26
Binnenmuur werkers	2	4	2.1 0.6-4.0	0.043 0.016-.084
Bouwplaats schoonmakers	6	12	1.0 0.1-2.5	0.032 0.002-0.097
Achtergrond blootgestelden	4	6	0.3 0.1-0.4	0.005 0.002-0.015

E. Tjoe-Nij. OEM 2003: 60:410

male, 52 yrs; construction worker

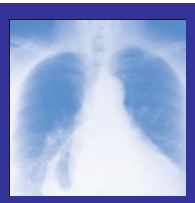


Silica



Mineral

- element silicon (Si)
- complexes: SiO_2
  crystalline silica (quartz, cristobalite, and tridymite)
  amorphous, glassy
- quartz: natural stone, sand, sand stone
- respirable: 0.2 – 10 µm; MAC: 0,075 mg/m^3
- health effects

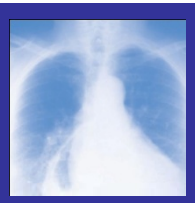


Disorders associated with exposure to quartz

- Silicosis – (mixed dust) pneumoconiosis
- Lungcancer (IARC: class 1 carcinogenic agent)
- COPD (chronic bronchitis, emphysema)
- Tuberculosis

Possibly:

- Reumatoid arthritis, auto-immune and renal disease



Silicosis

Interstitial Lung Disease (ILD)

- irreversible, may lead to fibrosis,
- may be progressive after removal from exposure

3 forms:

- chronic: > 10 yrs (relatively low) exposure
- accelerated: < 5-10 yrs, higher levels of exposure
- acute: weeks – months, extremely high exposure

ACOEM – evidence-based statements. JOEM 2006;48:95

Silicose?

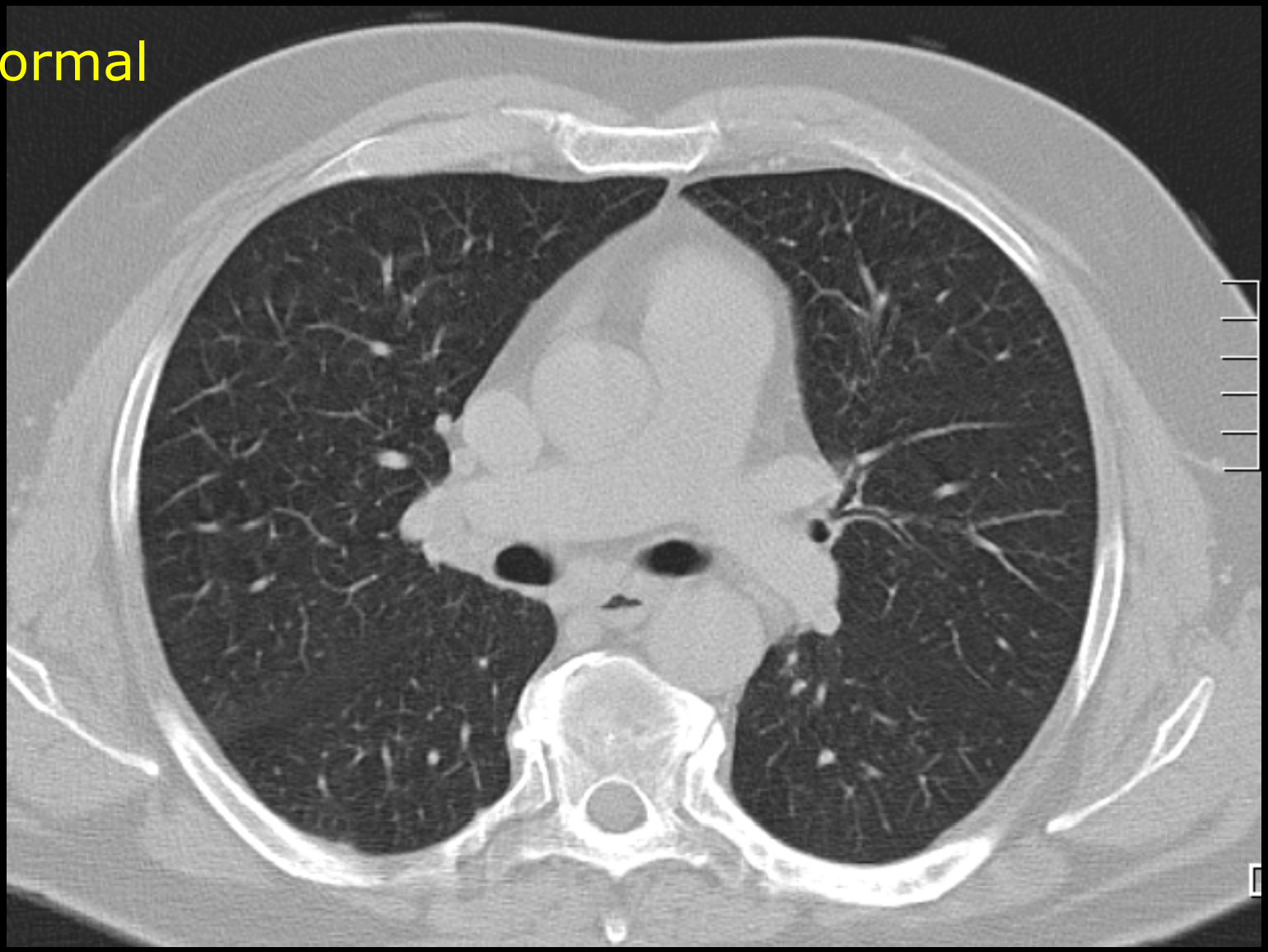
Anamnese: Patiënt is sinds 18 jaar werkzaam in de bouwnijverheid als betonreparateur. In het verleden 7 jaar, tot 1991 gewerkt bij Eternit in Goor. Hij maakt gebruik van een halfgelaatsmasker en indien beschikbaar van stofbeperkende apparatuur. Door de jaren heen is de stofbelasting afgenomen.

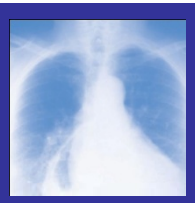
Longen: Heeft sinds 4 jaar weinig progressieve klachten van kortademigheid bij inspanning zoals traplopen en tillen, maar ook op zijn werk vooral als het stoffig is. Hij moet dan soms even rusten. Geen aanvallen, geen nachtelijke klachten, geen hoesten. Aspecifieke prikkels zoals temperatuurwisseling doen de klachten toenemen.

Niet bekend met tuberculose(contact).

High Resolution - Computed Tomography (HR-CT)

Normal





Silicosis: clinical signs and symptoms

Symptoms

- in many cases absent until advanced stage
- age > 40 yrs
- slowly progressive over time
- cough, phlegm, breathlessness on exertion, disabling
- confused with COPD (chronic bronchitis due to smoking)

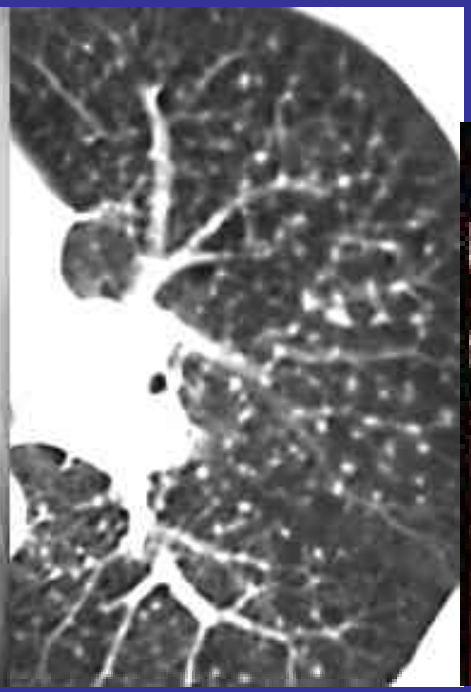
Lung function

- airway obstruction en restriction (fibrosis)

Imaging

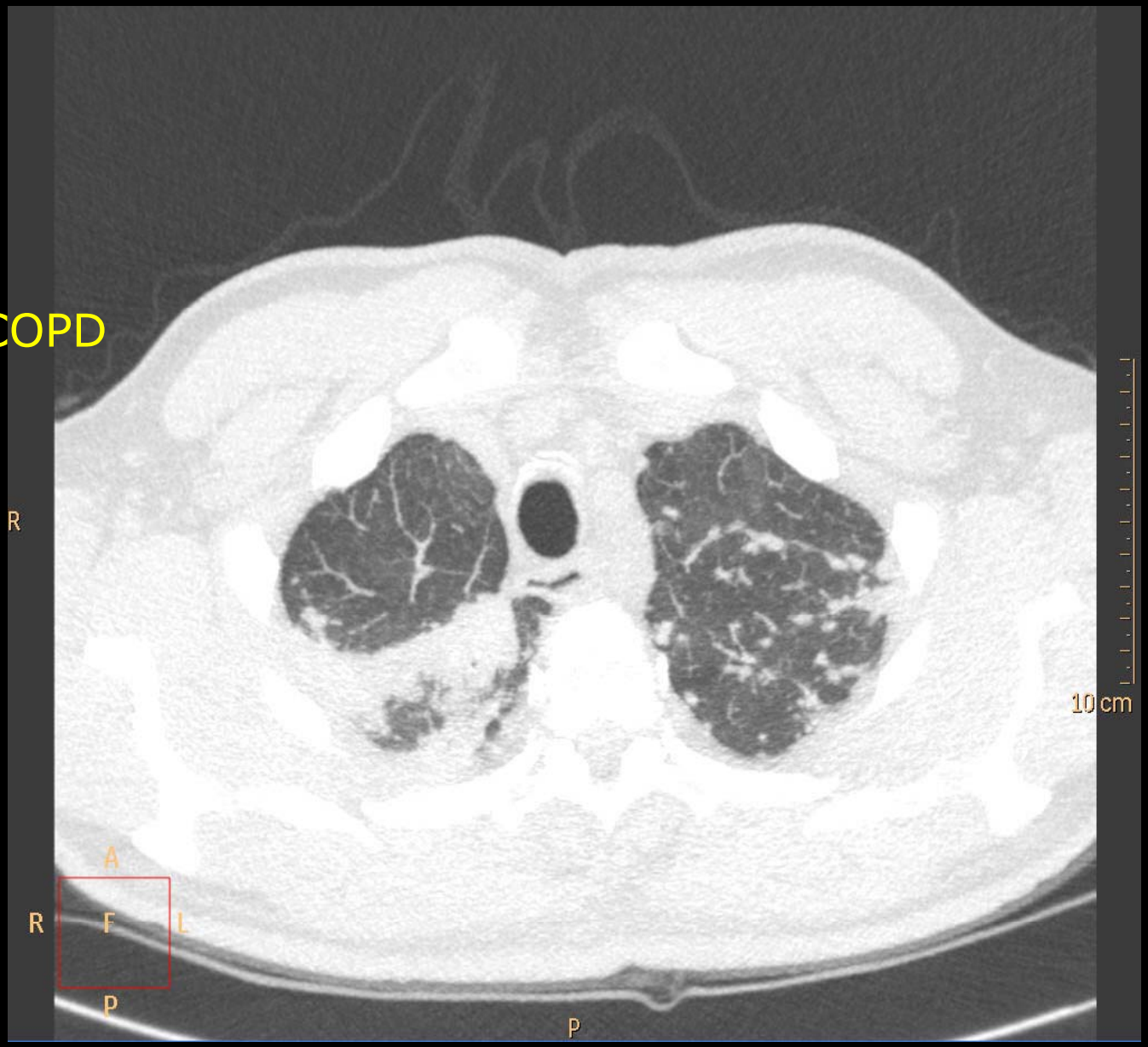
- Chest X-ray: ILO classification
- (High Resolution)CT-scan promising

Early detection of silicosis in construction workers



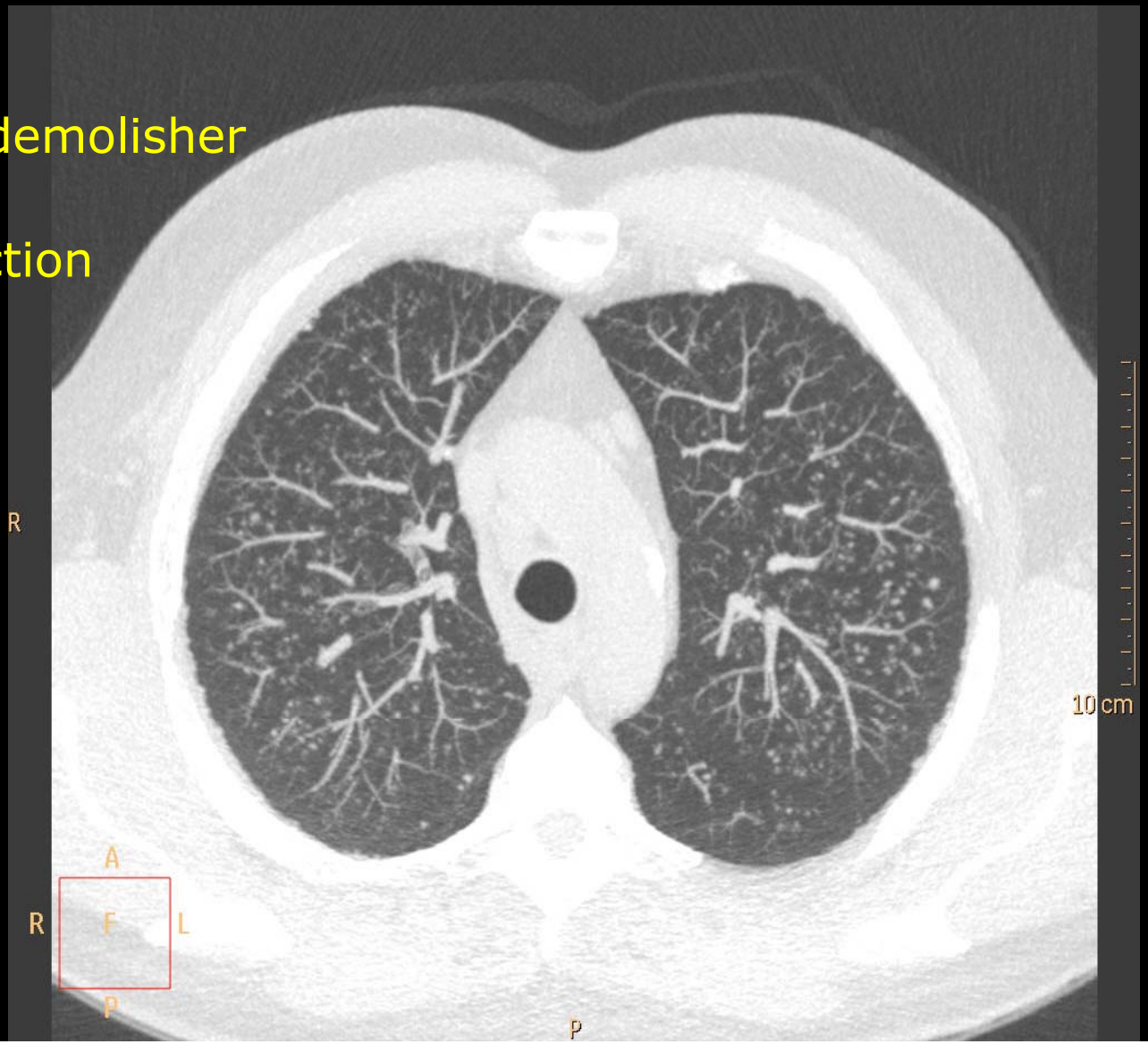
Silicosis – advanced stage (fibrosis)

male, 57 yrs
demolisher
smoker
lung function: COPD



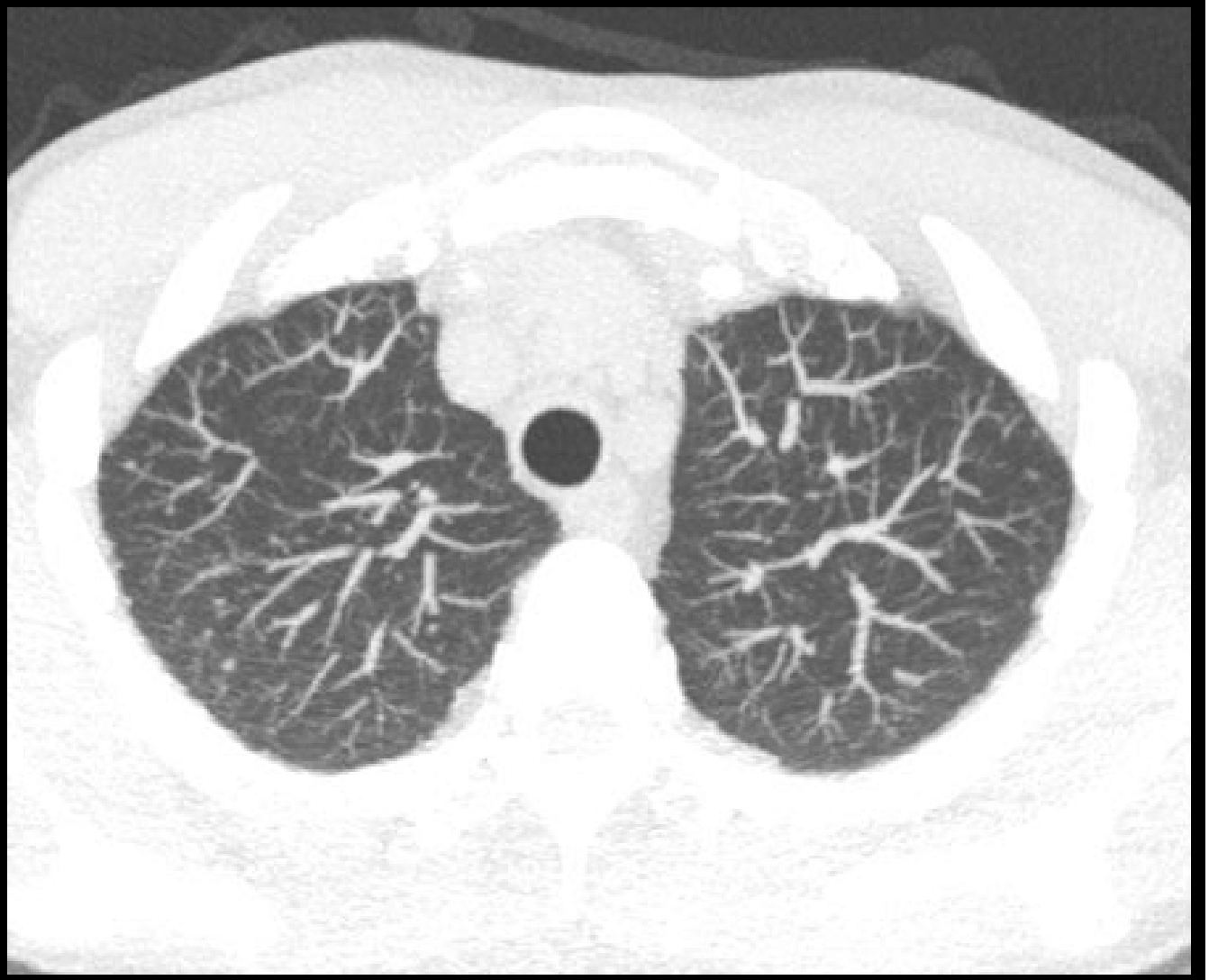
Silicosis

male, 50 yrs
concrete driller, demolisher
heavy smoker
normal lung function



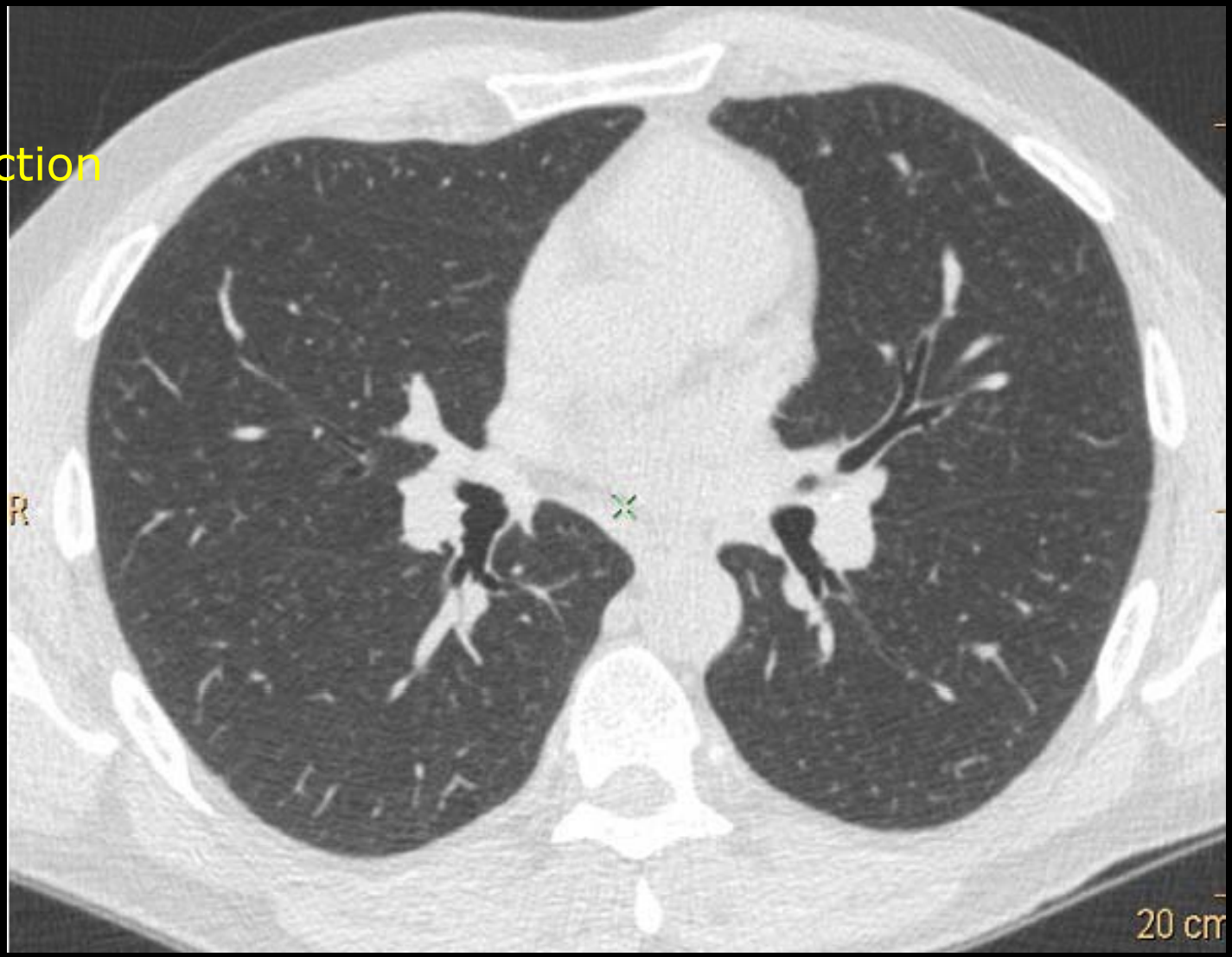
Silicosis - early stage

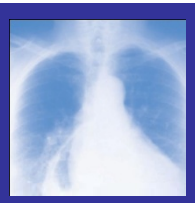
male, 49 yrs
repairman, driller
smoker, 7 py
normal lung function



Silicosis ?

male, 45 yrs
concrete worker
heavy smoker
normal lung function





Silicosis

Diagnosis

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

Therapy

- not available

Prevention

- early detection
- exposure measures only tool

Medical Surveillance of Workers Exposed to Crystalline Silica

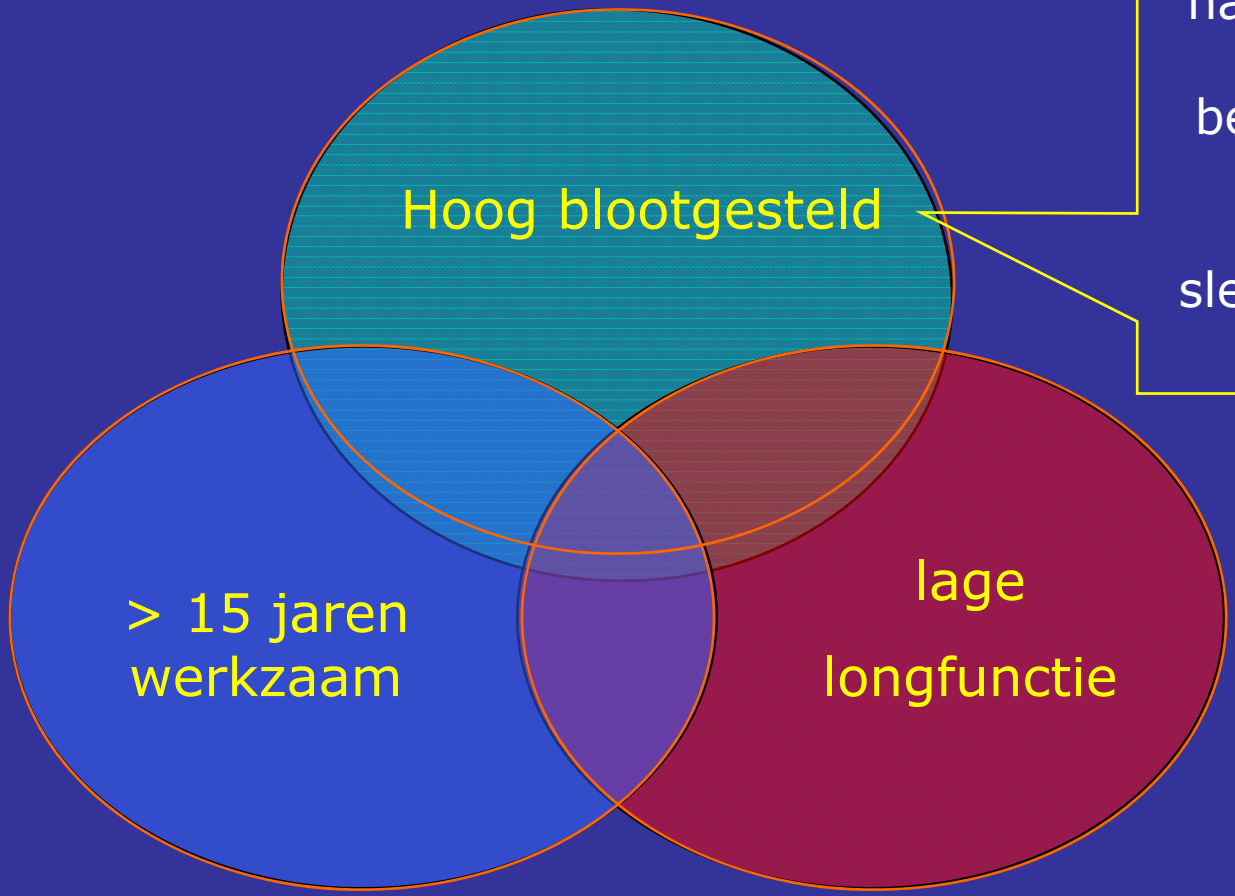
ACOEM – evidence-based statements

Target group:	*silica concentration* ***> 0.05 mg/m³*** *(NIOSH)*
Medical evaluation:	*Questionnaire, mantoux, X-thorax,*
	lung function
Interval:	*baseline – 1 yr – every 2- 3 year - exit*
In case of silicosis:	*stop individual exposure;*
	exposure assessment and control measures (population)

Education- Monitoring- Supervision

ACOEM – evidence-based statements. JOEM 2006;48:95

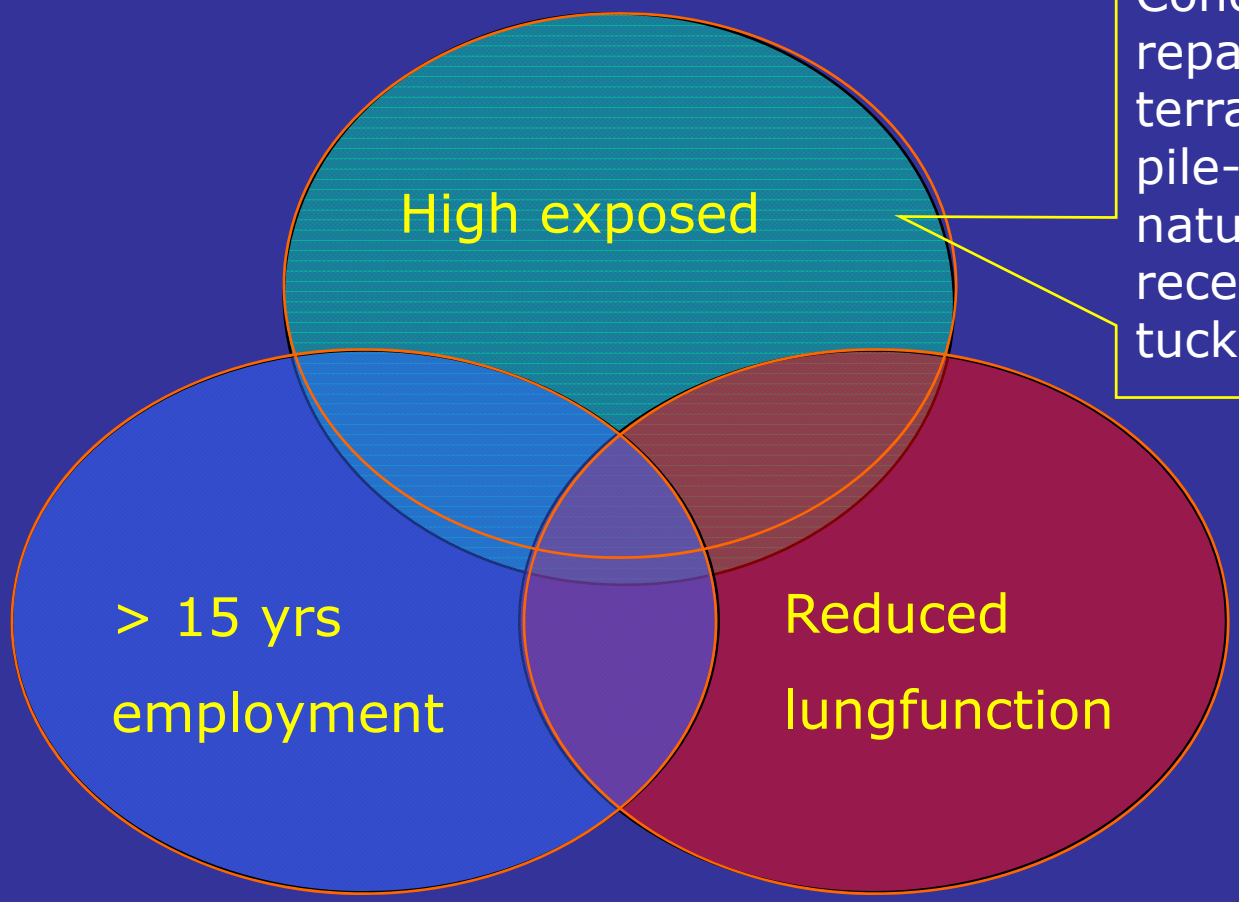
Silicose: sterkste voorspellers



natuursteenbewerker,
terrazzowerker,
betonboorder/-zager,
betonreparateur,
koppensneller,
sleuvenhakker/-frezer,
sloper

E. Tjoe-Nij. OEM 2003: 60:410

Silicosis: strongest predictors in construction workers



Concrete drillers,
repairmen, grinders,
terrazzo workers,
pile-top crushers,
natural stone workers,
recess millers,
tuck pointers

Tjoe-Nij E. OEM 2003: 60:410

Diagnostic Model

N = 1293 *X*-ray with ILO profusion category > 1/1

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

Suarthana E. OEM 2007: 64:595

Diagnostic Model: Example

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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

45 yrs, non-smoking, concrete driller,
10 yrs employed, feeling healthy,
standardized residual FEV1 of -1:
Sumscore 3.75

Risk Stratification

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
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Predicted probability of outcome (%)	0	1	2	2.5	3	5	8	19	45

Low score
No action

High score:
HRCT-scan

Health Surveillance Programme

Organisation, data collection, risk stratification

ARBOUW: employers and employees organisation
for occupational health and safety
in the **construction industry**

Questionnaires, tests, and referral

Occupational health care services

Medical screening, data analysis

NECORD / IRAS - Utrecht University

Risk stratification

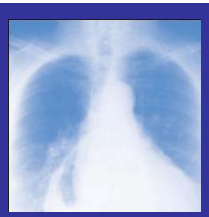
Periodic occupational medical examination
Data 2006 - 2007

Sumscore	0	≥1	≥2	≥3	≥4	≥4.75	≥5
Workers (n)	36741	31993	22173	7092	1316	1119	174
%	100	87	60	19	4	3	0,5

Results in 160 construction workers high risk, sumscore ≥ 5

Selected from 36.741 → 174 workers with a high score

N = 160	Gem (sd)
Age *yrs*	50.0 (6.0)
Length *m*	178.6 (7.0)
Weight *kg*	87.3 (14.5)
Pack years	25.9 (15.6)

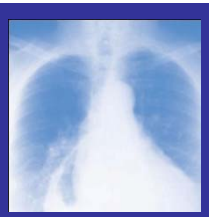


NECORD out patient clinic

UMC Utrecht

First results in 160 construction workers

Silicosis	7 (4%)
Suspected/ limited silicosis	12 (12%)
Follow up needed	17 (17%)



Silicose

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Hoe ziet u interventie en controle?

Beleid gericht op beheersmaatregelen?

Hoe richt u monitoring in?

Silicose

Advies

Bedrijfsarts: blootstelling aan (kwarts)stof dient onmiddellijk, definitief en absoluut te worden vermeden, waarbij het voortzetten van zijn huidige werkzaamheden onverantwoord is.

Verdenking of vroege silicose

Advies

Bedrijfsarts: In het kader van zijn aandoening en preventie is bijzondere aandacht vereist voor de arbeidshygiënische strategie, blootstelling aan stof dient maximaal te worden vermeden. Naast primaire maatregelen gericht op stofontwikkeling is juist gebruik van adequate adembescherming noodzakelijk.

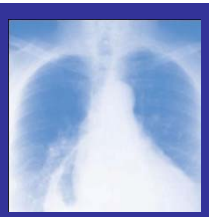
Evaluatie van de blootstelling is nodig, waarbij wordt verwezen naar beschikbare instrumenten van Arbouw (Beroepsspecifieke protocollen voor kwartsstof reductie; stoffenmanager; www.stofvrijwerken.nl).
Neem indien nodig (aanvullende) beheersmaatregelen (algemeen, individueel) en controleer.

Verdenking of vroege silicose

2

Bij potentieel relevante blootstelling:
Verricht (persoonsgebonden) metingen om zekerheid te krijgen omtrent de mate van blootstelling.
Neem (aanvullende) beheersmaatregelen (algemeen, individueel) en controleer.

Terugkeer in eigen werk wordt ontraden indien bovenstaande beheersmaatregelen onvoldoende effect hebben op de blootstelling.



NECORD out patient clinic

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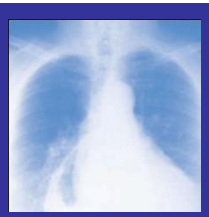
First results in 160 construction workers

N =160	Post bronchodilation Gem (sd)	% predicted Gem (sd)
VC *l*	5.02 (0.86)	106.4 (14.8)
FEV_1 *l*	3.60 (0.73)	96.2 (15.9)
FEV_1/VC %	71.6 (9.0)	



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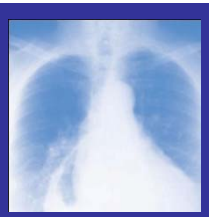
First results in 160 construction workers

COPD : Chronic Obstructive Pulmonary Disease

41 (26%)



NECORD out patient clinic

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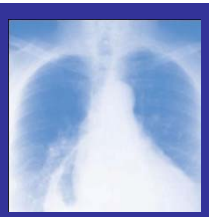
First results in 160 construction workers

N= 160	Aantal	%
COPD GOLD I	27	17
COPD GOLD II	12	8
COPD GOLD III	2	1
COPD Totaal	**41**	**26**
Astma	14	9

COPD

Advies

Huisarts/Bedrijfsarts: Monitoring van klachten en longfunctie is aangewezen. Bij progressie van de klachten dient patiënt opnieuw te worden beoordeeld, waarbij het onderzoek zich tevens zal richten op de belastbaarheid. Verwezen wordt naar de NVAB richtlijn astma en COPD (www.nvab-online.nl).



Conclusion

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Risk stratification by a diagnostic model,
low-dose HRCT-scan and lung function

- May rule out silicosis in a subset of workers
- Is effective in detecting silicosis and chronic bronchitis in a high number of workers at risk
- Helps to select workers for
  individual targeted therapy, monitoring and exposure measures,
  and may thus prevent progression of disease

Netherlands Expertise Centre for Occupational Respiratory Disorders

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	Ing. Mischa Zengeni,	*lung function-technologist*
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