# MORTALITY AND CANCER INCIDENCE AMONG SWEDISH CERAMIC WORKERS WITH SILICOSIS

GÖRAN TORNLING*† • C. Hogstedt*‡ • A. Gustavsson‡ • P. Westerholm§

*Departments of Occupational Medicine and †Thoracic Medicine
Karolinska Hospital, S-104 01 Stockholm
‡National Institute of Occupational Health, Solna
§The Swedish Trade Union Confederation, Stockholm. Sweden

The question whether quartz exposure increases the risk for lung cancer was raised 50 years ago by Anderson & Dible.[1] More recently two literature reviews considering both animal experiments and epidemiological investigations have been published, one talking for[3] and the other against[4] such an association. In most published epidemiological investigations the subjects have, beside quartz, been exposed to known lung carcinogens such as polycyclic aromatic hydrocarbons in the foundry industry and ionizing radiation in mining, which make the interpretation difficult.[5] This investigation, which has become a part of a multicenter initiative by IARC, was undertaken in order to study the risk for lung cancer in the Swedish ceramic industry, where no confounding lung carcinogens are known to occur.

## MATERIAL AND METHODS

The Swedish Pneumoconiosis Registry has compiled case notifications from 1931 and onwards. The study population consists of those 314 males from the ceramic industry who had been accepted as compensated cases of silicosis. Since there were only 36 females they were excluded from analysis.

The vital status of the study persons was established by linking the ten-digit identification number based on time of birth for each person with the census register for all living persons in Sweden, the death register of all deceased persons in Sweden, and the emigration register. By these procedures all but one of the persons could be identified as alive or deceased during the study period.

During the study period (1951–1985) for the mortality analysis the study population has accumulated 5695 person-years. Cause of death from the death certificates was recorded on all deceased persons in the study population.

The Swedish Cancer Registry was established in 1958 and receives notifications on more than 95% of all malignancies. During the study period (1958–1983) for the cancer incidence calculations the study population had accumulated 4247 person-years. The cancer morbidity was established by linking the identification numbers of the individuals in the study population with the National Cancer Register.

The expected number of deaths and malignancies was calculated by multiplying person-years of observation within five-year age categories during each year of the study periods by site- and gender-specific national rates. The calculations of standardized mortality/morbidity rates (SMR) with 95% confidence intervals (CI) based on a Poisson distribution was performed by a computer program developed at the University of Linköping (EPILIN program package).

## RESULTS

The overall mortality in the study population was increased (SMR=138; CI 120–157) due to an excess in mortality from respiratory tuberculosis (SMR=1932; CI 1144–3054) and other non-malignant respiratory diseases (SMR=746; CI 577–947).

There was no overall increased incidence of malignant diseases in the study population (SMR=94; CI 67–126). However, nine cases of lung cancer were observed vs. 4.8 expected (SMR=188; CI 85–356). With a latency time requirement of 10 years from discovery of silicosis SMR was 236 (CI 107–448), and with a latency time of 20 years there was a further increase (SMR=267; CI 98–582). Lung cancer was diagnosed 36–72 years after first quartz exposure and 11–32 years after that silicosis had been detected.

## DISCUSSION

The results from this study on Swedish ceramic workers with silicosis demonstrate an increased mortality in non-malignant, but not in malignant, respiratory diseases. However, the lung cancer incidence was doubled.

The size of the cohort is small, and we have no data on smoking habits in the study population. The results are, however, in accordance with other studies on silicotics from the ceramic industry. An increased risk among pottery workers of dying from lung cancer has been reported, especially if they had been exposed to talc,[7-9] but also in individuals with no talc exposure.[8] Talc was, however, only used in four of the 19 factories in our study, and the lung cancer cases were not accumulated to these factories. A recent Italian case-referent study among ceramic workers controlling for age, period of death and smoking did also show an increased lung cancer risk, especially among individuals with silicosis.[2]

The mechanism for a carcinogenic effect of quartz is not clear. A direct carcinogenic effect is supported by the cytotoxic effect of quartz *in vitro*.[6] It has been shown

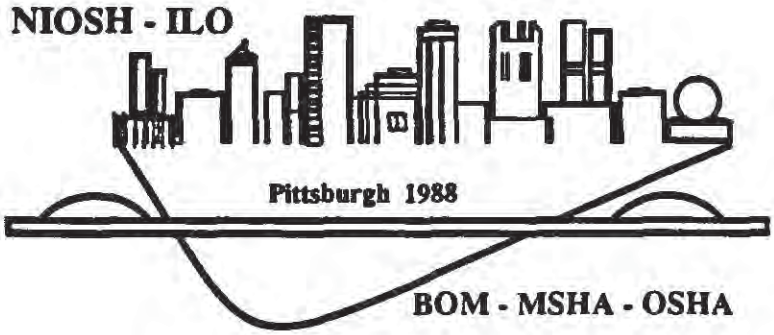
among ceramic workers that silicotics have a greater risk for lung cancer than non-silicotics.[2] This could be due to a higher quartz exposure, but a causal relationship between the silicotic lesions and the cancer should be considered. Fibrotic lesions in the lung might impair the pulmonary clearance mechanisms for various carcinogenic substances, and a high incidence of bronchial carcinoma has been reported among individuals with various fibrotic lung diseases without relationship to dust exposure.[10]

## REFERENCES


1. Anderson, C.S., Dible, J.H.: Silicosis and Carcinoma of the Lung. *J. Hyg.* 38:185-204 (1938).
2. Forastiere, F., Lagorio, S., Michelozzi, P., Cavariani, F., Arcaω, M., Borgia, P., Perucci, C., Axelson, 0.: Silica, Silicosis and Lung Cancer among Ceramic Workers: a Case-Referent Study. *Am. J. Ind. Med.* 10:363-370 (1986).
3. Goldsmith, D.F., Guidotti, T.L., Johnston, D.R.: Does Occupational Exposure to Silica Cause Lung Cancer?. *Am. J. Ind. Med.* 3:423-440 (1982).
4. Heppleston, A.G.: Silica, Pneumoconiosis and Carcinoma of the Lung. *Am. J. Ind. Med.* 7:285-294 (1985).
5. *IARC.: Monographs on the Evaluation of the Carcinogenic risk of Chemicals to Humans Vol 42. Silica and some Silicates.* IARC, Lyon (1987).
6. Langer, A.M., Nolan, R.P.: Physiochemical Properties of Quartz Controlling Biological Activity. *Cancer-Research Monographs.* 2:125-135 (1986).
7. Thomas, T.L.: A Preliminary Investigation of Mortality among Workers in the Pottery Industry. *Int. J. Epidemol.* 11:175-180 (1982).
8. Thomas, T.L., Stewart, P.A.: Mortality from Lung Cancer and Respiratory Diseases among Pottery Workers exposed to Silica and Talc. *Am. J. Epidemiol.* 125:35-43 (1987).
9. Thomas, T.L., Stewart, P.A., Blair, A.: Nonfibrous Dust and Cancer: Studies at the National Cancer Institute. *Cancer Research Monographs.* 2:441-450 (1986).
10. Turner-Warwick. M.: *Immunology of the Lung.* Edward Arnold, London (1978).


ACKNOWLEDGEMENT: The study was supported by grant 86-1391 from the Swedish Work Environment Fund.

*Proceedings of the VIIth International Pneumoconioses Conference* | *Part* **I**
*Transactions de la VIIe Conférence Internationale sur les Pneumoconioses* | *Tome* **I**
*Transaciones de la VIIa Conferencia Internacional sobre las Neumoconiosis* | *Parte* **I**




Pittsburgh, Pennsylvania, USA—August 23–26, 1988
Pittsburgh, Pennsylvanie, Etats-Unis—23–26 aout 1988
Pittsburgh, Pennsylvania EE. UU—23–26 de agosto de 1988

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Centers for Disease Control
National Institute for Occupational Safety and Health

CDC
CENTERS FOR DISEASE CONTROL

## Sponsors

International Labour Office (ILO)
National Institute for Occupational Safety and Health (NIOSH)
Mine Safety and Health Administration (MSHA)
Occupational Safety and Health Administration (OSHA)
Bureau of Mines (BOM)

September 1990

## DISCLAIMER

Sponsorship of this conference and these proceedings by the sponsoring organizations does not constitute endorsement of the views expressed or recommendation for the use of any commercial product, commodity, or service mentioned.

The opinions and conclusions expressed herein are those of the authors and not the sponsoring organizations.

**DHHS (NIOSH) Publication No. 90-108 Part I**