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FOREWORD

# Silica and lung cancer: state of the art, practical implications and future research

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**Key words**

Silica; lung neoplasms; occupational health and safety

In one of the innumerable reviews and metanalyses on silica and lung cancer, together with my colleagues Carol Rice and Mustafa Dosemeci, commenting the 1997 IARC conclusion classifying silica as a human carcinogen we raised the following point: "*While the overall epidemiological evidence suggests that, under certain circumstances of exposure, silica behaves as a lung carcinogen, no major progress has been made thus far in identifying what exactly such circumstances are. Finding the answer is of paramount importance in preventing silica-related health effects other than silicosis, including lung cancer. However, most of the recent literature keeps repeating the traditional study designs, sometimes with additional features contributing to a more precise diagnosis or a more refined exposure assessment, oftentimes just updating the life status of old cohorts, in the attempt of increasing the statistical power or replicating the association under different exposure circumstances. In most instances, updates have confirmed earlier findings, leaving the uncertainties unchanged. Major developments in the scientific knowledge are not to be expected unless addressing the issue with new creative approaches.*" (4).

Not much progress has been made since then. Traditional studies, such as the update of mortality in the Vermont granite industry (12) and a population-based Dutch study (10), as was foreseeable and foreseen, keep providing conflicting results. In this special issue, IARC explains the rationale of its conclusion in the recent Volume 100 of its IARC Monographs Program (7), and Piolatto and Pira illustrate the point of view of the Italian Society of Occupational Medicine and Industrial Hygiene (9). While acknowledging heterogeneity across studies, IARC places value on the strong evidence of the association among silicotics, while the Italian Society of Occupational Health acknowledges the evidence of an association between silicosis and lung cancer but argues against the appropriateness of classifying it as a human carcinogen and proposes enforcing the application of current standards instead of introducing new, more restrictive limits whose cost/benefits might be disputable. One of the major reasons for such a long-lasting scientific dispute lies in the profound differences in the silica-lung cancer association observed across studies,

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and also by type of dusty trade within the same study, although the study design and the genetic and social background were very much alike (1,8). The plausible role of chance and confounding has been addressed up to exhaustion with sophisticated methodological approaches: in this special issue of *La Medicina del Lavoro*, Erren et al. state *"we feel that statistical methodology has outstripped the capacity of the standard data collected in most studies to-date to provide the much-needed clarification of the very role of the established silicosis-lung cancer association"* (5). An alternative way of describing exposure circumstances is also reported herein by Rice et al, creating new ways of modelling lung cancer risk according to dose of inhaled silica (11). All this work adds something, but I will leave the reader to speculate on how far scientific research can succeed in following such paths. Four years later, I cannot but remember what we stated in 2007 "*Keeping repeating the same path in the silica labyrinth does not help finding a way out*" (4).

Some attempts to move forward are presented here by the Italian Silica Network. Based on the implications of the IARC classification of silica as a Group 1 human carcinogen, several collaborative efforts have been initiated aiming to describe the exposure patterns in traditional dusty trades in central Italy and to highlight physical/chemical properties of silica particulates capable of modulating its bioreactivity, thus implementing methods to differentiate risk based not simply on airborne silica concentration (6). Special circumstances of silica exposure occur in the general population of the Xuan Wei County, China. Vermeulen et al. describe the US NCI project aimed at disentangling the effects of multiple exposures, including silica nanoparticulates, arising from using local coal for domestic cooking fuel (13). Special circumstances of silica exposure were previously described, but were not taken into much consideration for their contribution to a better understanding of the mechanisms linking workplace silica exposure to lung cancer risk (2, 3).

Until there is proof to the contrary, all the different opinions on silica effects should be considered as motivated by the aim of achieving the best protection of workers' health, which also means protecting them from unemployment or, sometimes, and particularly in small workshops, from themselves. Most of the rationale behind the silica argument lies behind the decision of what workplace standards should be applied and what would be the cost/benefit ratio of applying them. Apart from the legal implications, it is an ethical question. As it is an ethical question to protect workers' health and wealth worldwide, including the small factories and very small workshops in Europe, and the mining industry in Eastern Europe and South American, African and Asian countries to where the mining companies have been moving most of their businesses.

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