



## Occupational exposure to dust: an underestimated health risk?

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### TO THE EDITOR:

Occupational exposure to dust, even at low doses, is a risk to workers' health because it is significantly associated with respiratory symptoms. It is known that the length of exposure to airborne substances (dust, gases, vapors, or chemicals) is directly related to the likelihood of respiratory problems, as well as that of asthma, lung cancer, hypersensitivity pneumonitis, and other interstitial lung diseases.<sup>(1,2)</sup>

Despite the fact that, in most industries, air quality evaluations are carried out on a regular basis and the legislated exposure limits are being respected, workers sometimes have health complaints that might be attributable to occupational exposure to dust.<sup>(3,4)</sup> Therefore, we decided to apply a questionnaire to assess the impact that occupational exposure to dust has on the development of respiratory symptoms among workers at an automobile parts manufacturer in northern Portugal. At this writing, the factory is owned by a multinational group dedicated to the research, development, and production of equipment for the automotive industry, employing approximately 1,000 permanent workers and another 200 temporary workers. Most (85%) of the employees work in the production area, where there is dust formation, as well as vaporization and aerosolization of oil waste. The production cycle begins with the winding of wire into a spiral which is then coated with a plastic composite, under very high pressure with intense friction, producing a large amount of dust. The cables are then cut, and plastic or zamak (a zinc-aluminum-magnesium-copper alloy) is applied by injection. That process generates particulate matter: total dust (0-25 µm); breathable dust (0-10 µm); and volatile organic compounds, which have a particle phase. According to Portuguese law, periodic evaluation of the concentrations of particulate matter in the workplace atmosphere is required.<sup>(4,5)</sup> Specifically at the factory in question, there were air exhaust systems installed in the manufacturing area and at the workstations where the risk of exposure is highest. In addition, there were annual measurements of total dust, respirable dust, and concentrations of volatile organic compounds are measured by a certified external laboratory, including gravimetric measurement (weighing of filters), with air samples taken on a working day at the workstations with the highest exposure risk (i.e., those in the spiral manufacturing, extrusion, cutting, and injection areas).

Results are then compared to the exposure limits defined by Portuguese regulation.<sup>(4)</sup>

Over a 1-month period, the occupational health and safety department of the company provided each worker with a non-anonymous, voluntary, self-report questionnaire about the presence of ocular, nasal, and respiratory symptoms (including coughing fits, chest tightness, breathlessness, and dyspnea) and their relationship with the working period (yes/no questions). We chose to use a symptoms questionnaire because it is a simple, easily implemented, inexpensive way to obtain information on worker health status and is easily reproducible for occupational disease screening. Because there is no validated questionnaire for evaluating respiratory symptoms in the workplace in Portugal, the questionnaire used was adapted from the British Medical Research Council scale (1976 version) and the Control of Allergic Rhinitis and Asthma Test, which has been validated for use in adults in Portugal.<sup>(6)</sup>

The clinical files of the respondents were analyzed for demographic data, workstation type, duration of exposure to dust, history of respiratory diseases, smoking status, and most recent pulmonary function test results. The association between the presence of at least one respiratory symptom and the duration of exposure to dust was assessed by logistic regression.

A total of 207 workers completed the questionnaire: 58.5% were women; and the mean age was 38.7 years. Of those 207 employees, 161 (77.8%) worked in the production area, 38 (18.4%) worked in the logistics department; and 8 (3.8%) worked in the office. A total of 110 workers (53.1%) reported at least one respiratory symptom: ocular symptoms, in 48 (23.2%); nasal symptoms, in 67 (32.4%); coughing fits, in 48 (23.2%); chest tightness, in 40 (19.3%); breathlessness, in 41 (19.8%); and dyspnea, in 32 (15.5%). Of the 207 respondents, 31 (15.0%) reported having only one symptom, whereas 37 (17.8%) reported having two symptoms and 42 (20.3%) reported having three or more. Of the 110 workers who reported at least one symptom, 81 (73.6%) reported experiencing symptoms on working days and only 6 (5.5%) reported experiencing symptoms on their days off. When analyzing the clinical files of the respondents, we observed a median duration of exposure to dust of 9 years (7 years in men and 10 years in women), 97 (47%) of the respondents having worked at the company for more than 10 years, which

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**Table 1.** Multivariate analysis of symptoms and their association with the duration of exposure to dust.

Symptoms	OR	95% CI
Ocular	1.00	0.95-1.05
Nasal	1.02	0.96-1.07
Cough	0.96	0.91-1.02
Chest tightness	1.05	0.99-1.11
Breathlessness	1.04	0.98-1.10
Dyspnea	1.08	1.01-1.14

represents a significant duration of exposure to dust, especially for those who worked in the production area. Of the 207 respondents, 132 (63.7%) were nonsmokers, 67 (32.4%) were current smokers, and 8 (3.7%) were former smokers. The duration of exposure to dust correlated significantly with chest tightness, breathlessness, and dyspnea ( $p = 0.012$ ,  $p = 0.05$ , and  $p < 0.001$ , respectively). In a multivariate analysis (logistic regression and the Wald test), after adjusting for possible confounders, such as a history of respiratory diseases and smoking, we found that only dyspnea retained a statistically significant correlation with the duration of exposure to dust ( $p = 0.02$ ; Table 1). Although 31 (14.9%) of the respondents had impaired lung function, that was not influenced by the duration of exposure to dust ( $p = 0.263$ , Mann-Whitney test). Mild obstruction or obstruction of the small airways was the most common pattern in those workers, possibly related to asthma ( $n = 5$ ) and smoking ( $n = 21$ ). It was not possible to determine the relationship between the pattern of obstruction and exposure to dust, because of the small number of cases. The type of workstation did not have a statistically significant effect on the probability of respiratory symptoms. However, we must point out that most (77.8%) of the respondents worked in the production area, only 18.4% and 3.8% working in the logistics department and the office, respectively.

The symptoms evaluated in the present study were similar to those evaluated in other studies. In a study of workers exposed to free silica, Castro et al.<sup>(7)</sup>

found a prevalence of respiratory symptoms similar to what was found in our study (cough in 30.5% and dyspnea in 11%), although the proportion of current or former smokers was higher (52%) in their sample.<sup>(7)</sup> Occupational exposure accounts for a substantial proportion (10-20%) of either symptoms or functional impairment consistent with COPD.<sup>(2)</sup>

We found that respiratory symptoms were more common on working days and that the duration of exposure to dust was an independent risk factor for dyspnea. Although the questionnaire employed was not designed to assess lung impairment, we found that the work environment was responsible for the respiratory symptoms reported in the studied population. Other studies analyzing the prevalence of respiratory symptoms and its association with occupational exposure have also reported the presence of upper and lower airway diseases.<sup>(8,9)</sup>

The present study demonstrates that, in addition to periodic measurements of air quality, increased efforts should be made to improve collective protection measures and to raise worker awareness regarding the proper use of personal protective equipment, in order to reduce the risks of exposure to dust. We cannot rule out the possibility that the symptoms reported in our study were related to inappropriate use of personal protective equipment, because that was not a focus of our analysis.

As a result of this study, the occupational health department of the company implemented a respiratory surveillance plan, including collective lectures about occupational risks, risk prevention, and safety rules, especially the proper use of personal protective equipment. Workers also undergo periodic medical evaluation for the early identification of any respiratory symptoms.

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