# Dust diseases in modern Australia: a discussion of the new TSANZ position statement on respiratory surveillance

New measures are designed to improve health outcomes for workers in the coal mining, artificial stone and other dust-generating industries

In Australia, there has recently been a worrying resurgence of dust-related lung diseases (pneumoconioses) previously assumed to be obsolete. Pneumoconioses are chronic fibrotic lung diseases produced by inhaling mineral dust or dusts (*pneumon* = lung; *konis* = dust [Greek]). Conditions include coal workers' pneumoconiosis (black lung disease) and silicosis.[1-4] Many cases of these diseases have been described in Australia for the first time in over 40 years, including a new type of accelerated silicosis caused by cutting and polishing engineered (artificial) stone seen in kitchen and bathroom benchtop workers.[5,6] The latter has occurred in men, often at the height of their working lives, producing much disability and distress and resulting in completely preventable deaths. Artificial stone silicosis differs from other types of silicosis in that it progresses more rapidly and is also associated with a higher rate of development of autoimmunity than classical silicosis.

Pneumoconiosis has recurred primarily due to a widespread failure of regulatory controls in a situation where the medical evidence for efficacy of surveillance and prevention is very well established.[7-9] This has included deficiencies in dust monitoring and control, even in industries where lung health is notoriously at risk (eg, mining), as well as potential changes in dust exposure due to increases in length of shifts and changes in mining technologies.[9-11] New technologies may have altered the types and characteristics of respirable dust particles as well as the total dust levels.[4,12] In some industries, new products like artificial stone have been introduced without adequate awareness of likely hazards, alongside lack of labelling, inadequate respiratory protection, and widespread complacency about dust control measures.[13] Dry cutting of stone is notoriously dangerous,[7,8] yet was occurring frequently and is still not banned throughout Australia. Many employers (often in small businesses without access to any occupational medical advice) did not appreciate the potential hazards of products they were using, and were not warned by the regulators. Thus, they failed to assess the type or levels of respirable dusts, implement any health surveillance, or use even basic dust control measures.[7,8]

Because symptoms occur only very late in these diseases, workers were often unaware of any adverse effects. Many workplaces were non-unionised and workers came from non-English speaking backgrounds, and did not have access to information about dust hazards and ways to find help. Workers were reluctant to be identified because of job insecurity and financial concerns. Even after a respiratory abnormality had been identified, there was sometimes a failure to identify the disease as occupational in origin.[10,11] It was only after cases of severe disease were described by the medical profession, and after several cases had been referred for lung transplantation, that the resurgence of pneumoconiosis was identified.[3-5] These events are a stark reminder that occupational lung diseases are still a real issue in Australia and that we as health professionals need to maintain vigilance to prevent them in the future.

As health professionals, we also need to be aware of the full range of health effects resulting from dust exposures. Inhaled dusts have been shown to cause a broader range of disorders than was originally understood.[7,8,14] Pneumoconiosis is only one of several lung disorders which can arise from dust inhalation. In general, high dust levels are needed to produce lung fibrosis; however, other diseases have different, often lower, dose–response profiles. There is now convincing evidence that coal and silica/silicate dust inhalation also produces chronic bronchitis, emphysema and diffuse dust-related pulmonary fibrosis,[7,8,14] and that these effects are additive and not only attributable to tobacco smoking. It is also underappreciated that lung cancer and tuberculosis risk rises in a dose-related manner after silica exposure, and particularly with silicosis itself.[7,14,15] Dust exposure is a factor related to several systemic connective tissue diseases,[16,17] including Sjögren's syndrome, rheumatoid arthritis and mixed connective tissue disorder,[18] and renal dysfunction has also been described.[7,8] Positive auto-antibodies are particularly common after artificial stone exposure.[16] Clinicians must therefore be aware that inhaled dust produces a broader spectrum of disease than just pneumoconiosis.

The primary management of pneumoconiosis has always been to reduce or stop dust exposure. This slows the rate of progression of disease and increases time from exposure to development of symptoms (or disease latency).[7,8,19] This has been the rationale for respiratory surveillance programs, which involve regular assessment of a worker's respiratory health in the workplace every few years, and usually include a questionnaire, spirometry and chest x-ray, with reduction or removal from exposure once a threshold for early disease diagnosis has been reached. These programs have been the cornerstone of the reductions in incidence of pneumoconiosis worldwide[19,20] and are compulsory for workers exposed to several dusts in most Australian states and territories. General practitioners often become involved in these programs

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either as examining doctors or after an abnormal result has been detected, and are key players in ensuring disease recognition, implementing appropriate work plans, and referring for support.

It was because of serious concerns about disease resurgence that members of the Thoracic Society of Australia and New Zealand (TSANZ), Australia's primary organisation representing respiratory health, developed recommendations in June 2016 aimed at controlling coal mine lung dust diseases.[3] The TSANZ suggested standardisation of coal mine dust exposure limits throughout Australia, and alignment to international standards (which were generally lower levels than those in Australia). It also suggested a standardised national surveillance program for at-risk workers and highlighted the need for better education regarding occupational hazards.[3]

Following media interest and political support, the federal government established a National Dust Disease Taskforce[21] to establish a national approach to the prevention, early identification, control and management of occupational dust diseases. It supported establishing a National Dust Disease Register and provided some funds for new research.[21]

To assist with the forthcoming recommendations of this Taskforce, the TSANZ has reviewed the evidence and developed a position statement[22] in light of advances in knowledge and new techniques available for diagnosing respiratory disease. Respiratory surveillance programs for pneumoconioses[22] have been mainly based on the World Health Organization recommendations from the late 1970s,[19] but respiratory medicine has advanced since those times, enabling detection of much earlier disease. Modern computed tomography scans provide excellent visualisation of lung anatomy at much lower radiation doses than before, and global initiatives have standardised lung function measurement and reporting.[23] The gathering, storage and analysis of data have been revolutionised.

In its position statement, the TSANZ recommends enhanced methods for respiratory surveillance of dust-exposed workers using contemporary methods[22] (Box 1). Despite legislated reductions in exposure limits,[24-27] dust levels may not always achieve these limits, and workplace exposure data need to be collected and made available in a central repository to enable improved assessment of a worker's likelihood of developing disease. This would also significantly improve existing understanding of dose–response relationships, especially with artificial stone. Periodic assessments of respiratory health need to involve a standardised format and high quality, standardised imaging and full lung function assessments. Workers with early abnormalities need to be optimally clinically assessed, treated where possible, and protected by suitable legislation from loss or downgrading of employment.[22]

Implementing such recommendations will inevitably involve detection of other lung disorders, including those which are non-occupational in origin, and workers will be referred back to their GP for advice. It is therefore important that GPs understand the possible spectrum of diseases induced by dusts and other toxins, and obtain adequate and ongoing training in occupational lung disorders, including local support systems and when to refer for specialist advice (Box 2). The Royal Australian College of General

**1 Thoracic Society of Australia and New Zealand (TSANZ) proposed improvements to periodic health surveillance in the coal mining and artificial stone industries[22]**

- Regular training of staff in accordance with international standards of respiratory surveillance (including quality control and assurance).
- Plain chest radiographs to be performed using International Labour Organization recommended techniques, technically acceptable, with classification only by qualified thoracic radiologists, and compared with previous images.
- Individual spirometry to be performed according to American Thoracic Society/European Respiratory Society standards; results to be interpreted using reference values of the Global Lung Initiative. Serial data to be compared with longitudinal predicted values using the lower limit of normal to define lung function abnormality, and spirometry longitudinal data analysis software (SPIROLA).
- Dust monitoring to be performed under typical working conditions (≥ 75% capacity) and recorded using an accredited facility, with individualised data available for periodic surveillance.
- Extending surveillance methods for artificial stone exposure to potentially include low dose CT. Careful evaluation of the role of ultra low dose CT for coal miners and artificial stone workers in longitudinal prospective studies.
- Extending surveillance methods for all workers to include lung diffusing capacity (DLCO) at intervals of 3 years or less; careful evaluation of such surveillance within longitudinal prospective studies.
- A flexible, individualised approach to the timing of surveillance of coal mine dust workers, including annual spirometry and DLCO if results are abnormal but do not yet fulfil diagnostic criteria for disease.
- Active case finding for artificial stone workers previously exposed to high respirable crystalline silica levels using conventional high resolution CT/spirometry/DLCO performed at accredited respiratory laboratories and radiological facilities using recommended protocols; follow-up by expert treating specialists/teams, preferably at occupational respiratory disorder multidisciplinary team meetings.
- For artificial stone workers, pre-employment plain chest radiographs to exclude major abnormalities.
- For artificial stone workers undergoing active case finding without abnormal chest x-ray or high resolution CT, annual spirometry/DLCO and imaging 3-yearly or more often depending on individual factors and test results.
- Chest x-ray imaging to be complemented with high resolution CT scans in high risk groups (eg, borderline fibrosis found on plain chest radiographs and/or discrepancy with lung function findings).
- Improving existing medical databases to allow capacity to compare serial lung function data, occupational exposure history, imaging findings and dust measurements over time.
- Early evaluation of the diagnostic utility of best available tests (low dose CT, ultra low dose CT and DLCO) using data collected prospectively with consent from workers, ideally in a research setting.

CT = computed tomography; DLCO = diffusing capacity of the lung for carbon monoxide.
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**2 How to manage a case of possible pneumoconiosis in primary care: first steps**

- Be aware that many dusts, fumes and vapours can cause lung diseases. The time between exposure and disease occurrence (latency period) can be very long, usually years.
- Take time to go through a patient's full occupational history in detail, from leaving school to retirement. A chronological table of jobs may help (www.atsdr.cdc.gov/csem/exphistory/docs/CSEMExposHist-26-29.pdf).
- If the patient uses technical descriptions of a particular job, make sure you know exactly what they mean. Ask them to describe exactly what was done.
- Ask about conditions in the job, including dust controls like ventilation, use of personal protective equipment, dust measurements and any workplace respiratory health surveillance.
- Ask about shifts, including length of time worked and any improvements in symptoms when away from work (especially on holidays).
- Ask whether any other workers were affected.
- Ask if the patient has access to any safety data sheets. These are information sheets which are meant to be made available from the employer if a worker is exposed to a potentially hazardous exposure (www.safeworkaustralia.gov.au/sds). If unavailable, search the internet for the suspected agent of concern, or contact the Australasian Faculty of Occupational and Environmental Medicine to find a suitable occupational physician and obtain advice (www.racp.edu.au/about/college-structure/australasian-faculty-of-occupational-and-environmental-medicine).
- Make contact with an occupational health practitioner if possible (an occupational physician and/or occupational health nurse and/or occupational hygienist). Small employers may not employ such specialists, but a local occupational health practitioner may be a local GP. Be careful not to contact a patient's employer without obtaining permission first! Your local WorkSafe or similar government agency may be helpful in identifying a potential hazard and can often provide anonymous advice (ACT: www.worksafe.act.gov.au; New South Wales: www.icare.nsw.gov.au; Northern Territory: worksafe.nt.gov.au; Queensland: www.business.qld.gov.au/industries/mining-energy-water/resources/safety-health/mining; South Australia: www.safework.sa.gov.au; Tasmania: worksafe.tas.gov.au; Victoria: www.worksafe.vic.gov.au; Western Australia: www.workcover.wa.gov.au).
- Keep careful records of all the above. Negative information is also useful. Ensure that a complete history of the patient's other risk factors (eg, tobacco use, other inhaled substance usage) is recorded.
- Obtain relevant investigations performed to recommended standards (spirometry, chest x-ray, computed tomography scan if indicated).
- If there is reasonable suspicion of an occupational disease, refer to an occupational physician and/or a respiratory physician with occupational lung expertise (www.racp.edu.au/about/college-structure/australasian-faculty-of-occupational-and-environmental-medicine; www.thoracic.org.au).
- Costs of care may be covered by WorkCover if a link with employment is established, but this may take time to confirm. Standards for accepting an occupational disease vary in different jurisdictions and do not always accord with medical diagnoses. Other support is available to workers via their local SafeWork or similar government agency.

Practitioners has a training resource for GPs which is a useful tool.[28]

Ultimately, such a system should prove beneficial to the health of both the individual and the community. However, it will require support and careful implementation in its initial stages.

Early disease is difficult to distinguish in clinical practice from other lung pathologies, but difficulties in diagnosis can be overcome using modern techniques. International standards for diagnosis are available and new treatments are under evaluation. Multidisciplinary team meetings in hospitals have been established for respiratory disease diagnosis for many years and are now embedded nationally, and a similar system for occupational lung diseases would be a valuable addition to improving the diagnostic process. An occupational multidisciplinary team in each jurisdiction would bring together a wide range of specialties (primary care, occupational and respiratory medicine, occupational hygiene, radiology, pathology and allied health) and could assist hugely in improving diagnostic standards, improving expertise and disseminating information. This would be best advanced using new virtual technologies, which would also enhance involvement by community and rural physicians.

The TSANZ recommendations represent best practice on the basis of existing information and need to evolve with new evidence. The TSANZ has also recommended careful evaluation of the efficacy of new measures using prospective studies, and updating in the light of new research. Changing the system would inevitably require increased resources. However, long term costs are likely to eventually decrease for health services and the economy, given the chronic debilitating nature of these preventable diseases. The TSANZ recommendations are a start in the process of re-engaging industry and regulator, workers, doctors and politicians; hopefully, they will lead Australia towards a future where preventable death and disablement from occupational lung diseases does not occur.

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