



A wide scope of new developments in occupational allergy and clinical immunology

Susan M. Tarlo^a and Piero Maestrelli^b

This issue of *Current Opinion in Allergy and Clinical Immunology, Occupational Diseases* illustrates the wide range of current research interests relevant to respiratory and allergic occupational diseases. The issue addresses timely reviews on a method to predict chemical occupational sensitizers and the recent use of social media in occupational disease research. Articles also address some of the more traditional (old) diseases (silicosis and asbestosis) as well as newer problems such as the role of cleaning products in occupational allergic and respiratory diseases, and research into the interaction between air pollutants and allergic diseases.

There remain many unknown questions regarding the mechanisms of occupational rhinitis and asthma caused by hypersensitivity responses to low-molecular-weight chemical exposures, as recently reviewed in a conference proceedings document [1]. Identification of low-molecular-weight causes of human occupational asthma has largely relied on case reports and case series [2], but in many cases the exact mechanism of response is unknown. As new chemicals are introduced and new uses added for existing chemicals, it would be preferable to be able to identify risks of sensitization before cases arise. Research in this area has included animal studies, cell culture studies and qualitative (mechanistic) [1,3] or quantitative predictive models. The article by Drs Seed and Agius [4] in this issue describes progress in the use of quantitative structure–activity relationship (QSAR) models that were reported by Dr Agius *et al.* in the early 1990s and previously reviewed in this journal 9 years ago [5] to predict which chemicals are likely to be specific immunologic sensitizing agents. Such agents may potentially cause occupational asthma and rhinitis (assumed to usually be associated with specific IgE antibodies), or hypersensitivity pneumonitis (associated with IgG antibodies and a delayed hypersensitivity response). As they report, there is a better understanding of the use of QSAR and characterization of positive and negative predictive values. Clinicians can take advantage of these methods to identify chemicals with sensitizing potential in a quick and inexpensive manner. In addition, they

can help with the submission of new sensitizing compounds to QSAR analysis in improving the predictive performance of the model.

The other methodologic review in this issue, by Drs Harber and Leroy [6] covers the use of social media as a tool in research studies of occupational lung disease. As they note, despite widespread use of social media and despite significant potential for use in research studies, there is little documentation as yet of use in data acquisition for research. The illustrative study previously reported by the same authors [7] demonstrates the valuable information that may be gleaned from this approach. Some of the potential difficulties associated with such use are detailed by the authors in this review. As they note, greater use has been made of the internet for knowledge translation, such as webcasts, and videos and web-based patient education [8,9]. It appears likely that the potential benefits of using social media for lung health–workplace interactions will be much greater in the future than the very limited current utilization.

In contrast to these new methodologies, silicosis and asbestosis along with coal-miners pneumoconiosis have traditionally been important occupational lung diseases. As with other occupational diseases, they are often preventable and in settings such as North America and the United Kingdom, new cases of coal-miners pneumoconiosis and silicosis in miners have fallen over time. With increased mechanization, fewer miners are needed for the same production as compared with the early 1900s, and there have been improvements to reduce dust exposure in miners. Measures include the use of

^aRespiratory Division, Toronto Western Hospital, University Health Network, St Michael's Hospital, University of Toronto, Toronto, Ontario, Canada and ^bDepartment of Cardiology, Thoracic and Vascular Sciences, University of Padova, Padova, Italy

Correspondence to Dr Susan M. Tarlo, MB, BS, FRCP(C), Respiratory Division, Toronto Western Hospital, University Health Network, St Michael's Hospital, University of Toronto, EW7-449, 39 Bathurst St, Toronto, ON M5T 2S8, Canada. E-mail: susan.tarlo@utoronto.ca

Curr Opin Allergy Clin Immunol 2017, 17:61–63

DOI:10.1097/ACI.0000000000000354

sprayed water underground to reduce airborne dust, and fit-tested respiratory protective devices that can reduce exposures. Nevertheless, as previously reviewed by Petsonk *et al.* [10], the trend to reduced numbers of miners was reversed in North America since 2003, and also there are large numbers of current miners in countries such as China where preventive measures may not be optimum and risks of silicosis and coal workers pneumoconiosis continue. In addition, there are other exposures to silica that continue, such as sandblasting, glass making, grinding and polishing, and newer exposures that have also been associated with silicosis, such as jet silica blasting of denim jeans that has been associated with high mortality in Turkey [11], and the use of silica-containing new synthetic stone such as Caesarstone for kitchen counters, also associated with high risk of silicosis among workers installing these [12].

Although rates of asbestosis have also fallen in most developed countries, and many countries have banned the new use of asbestos and have introduced appropriate protection for workers removing asbestos, nevertheless there is still exposure to this, especially in developing countries. Therefore, it is important that research into silicosis and asbestosis continues. The article by Dr Takemi *et al.* [13] in this issue addresses the immunologic mechanisms of responses in patients with silicosis and responses to asbestos exposure, and illustrates the important differences in immune responses to these two agents that may help to explain the development of cancer with asbestos exposure and autoimmune diseases associated with silicosis.

More recent concerns about inhaled particulate effects on health have focused on particles in air pollutants and particularly diesel exhaust. These particles are fine and ultrafine with mass mean aerodynamic diameters 2.5 micron or less and 0.1 micron or less, respectively. As reviewed in the article by Drs Carlsten and Rider [14], traffic-related air pollution respiratory effects are significant and responses can be affected by environmental aeroallergen exposures and underlying atopy. Advances in understanding the mechanisms of these responses have been made by detailed studies that have included controlled human exposures and performed comprehensive evaluation of gene–environment interaction and epigenetics, as detailed in this review. In addition to the general public health implications of these studies, there is potential for greater exposure among certain working groups such as outdoor workers, especially in cities with high air pollution, or those responding to forest fires and other fires, as previously reviewed in this journal [15]. In addition, there are many indoor workers

with combined exposure to allergens and inhaled particulate matter for whom there may be relevance from the findings described in the current review.

The final occupational disease article in this issue by Drs Folletti, Siracusa and Paolocci [16] addresses an occupational topic that has been recognized as a concern for several years but remains unresolved: the respiratory effects of cleaning agents. There has been an ongoing research into potential mechanisms by which cleaning products can cause or exacerbate asthma at work. Many cleaning products contain several different chemicals, and as noted in the earlier article by Drs Seed and Agius [4], some can interact with other volatile products, such as the interaction of limonene (a common odorant in cleaning products) and ozone that from the structural predictive models may increase risk of sensitization. Although a few chemicals in cleaning products have been shown to be sensitizers, such as quaternary ammonium compounds, and in some patients an acute irritant exposure to cleaning chemicals causes asthma, nevertheless for many patients who work with cleaning agents it is very difficult to distinguish occupational asthma from coincidental onset of asthma, and to identify a causative chemical and mechanism. The article in this issue reviews the most recent findings. Of particular interest are new studies [17,18] that suggest that early life disadvantage may be a susceptibility factor in cleaners who develop asthma, and also that poor psychosocial working conditions may contribute.

This occupational disease issue of the journal therefore confirms an ongoing need for research in respiratory and allergic occupational diseases, as well as a need for knowledge translation, as these diseases are potentially preventable.

Acknowledgements

None.

Financial support and sponsorship

None.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. North CM, Ezendam J, Hotchkiss JA, *et al.* Developing a framework for assessing chemical respiratory sensitization: a workshop report. *Regul Toxicol Pharmacol* 2016; 80:295–309.
2. Baur X, Bakehe P. Allergens causing occupational asthma: an evidence-based evaluation of the literature. *Int Arch Occup Environ Health* 2014; 87:339–363.
3. Enoch SJ, Roberts DW, Cronin MT. Mechanistic category formation for the prediction of respiratory sensitization. *Chem Res Toxicol* 2010; 23:1547–1555.

4. Seed MJ, Agius RM. Progress with Structure–Activity Relationship modelling of occupational chemical respiratory sensitizers. *Curr Opin Allergy Clin Immunol* 2017; 17:64–71.
5. Seed MJ, Cullinan P, Agius RM. Methods for the prediction of low-molecular-weight occupational respiratory sensitizers. *Curr Opin Allergy Clin Immunol* 2008; 8:103–109.
6. Harber P, Leroy G. Social media use for occupational lung disease. *Curr Opin Allergy Clin Immunol* 2017; 17:72–77.
7. Harber P, Leroy G. Assessing work-asthma interaction with Amazon Mechanical Turk. *J Occup Environ Med* 2015; 57:381–385.
8. Ghajar-Khosravi S, Tarlo SM, Liss GM, *et al.* Development of a web-based, work-related asthma educational tool for patients with asthma. *Can Respir J* 2013; 20:417–423.
9. Lipszyc JC, Gotzev S, Scarborough J, *et al.* Evaluation of the efficacy of a web-based work-related asthma educational tool. *J Asthma* 2016; 53:1071–1075.
10. Petsonk EL, Rose C, Cohen R. Coal mine dust lung disease. New lessons from old exposure. *Am J Respir Crit Care Med* 2013; 187:1178–1185.
11. Akgun M. Denim production and silicosis. *Curr Opin Pulm Med* 2016; 22:165–169.
12. Kramer MR, Blanc PD, Fireman E, *et al.* Artificial stone silicosis [corrected]: disease resurgence among artificial stone workers. *Chest* 2012; 142:419–424.
13. Lee S, Hayashi H, Mastuzaki H, *et al.* Silicosis and autoimmunity. *Curr Opin Allergy Clin Immunol* 2017; 17:78–84.
14. Carlsten C, Rider CF. Traffic-related air pollution and allergic disease: an update in the context of global urbanization. *Curr Opin Allergy Clin Immunol* 2017; 17:85–89.
15. Choudhary H, Tarlo SM. Airway effects of traffic-related air pollution on outdoor workers. *Curr Opin Allergy Clin Immunol* 2014; 14:106–112.
16. Folletti I, Siracusa A, Paolucci G. Update on asthma and cleaning agents. *Curr Opin Allergy Clin Immunol* 2017; 17:90–95.
17. Svanes O, Skorge TD, Johannessen A, *et al.* Respiratory health in cleaners in northern Europe: is susceptibility established in early life? *PLoS One* 2015; 10:e0131959.
18. Radon K, Llanqui U, Arce A, *et al.* Job strain, bullying and violence at work and asthma in Peruvian cleaners-a cross-sectional analysis. *J Asthma* 2016; 53:1018–1025.