PostScript

LETTERS

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Use of personal exposure modelling in risk assessment of air pollutants

Kromhout and van Tongeren¹ raise important issues regarding the papers by Cherrie² and Harrison and colleagues.³ The major shortcomings of the paper by Harrison and colleagues³ are the small size of the sample (six subjects each) used in the extrapolation of results. The three groups studied were the children, the elderly, and subjects with preexisting disease. The sample size in the disease category used only two subjects each with chronic obstructive pulmonary disease (COPD), left ventricular failure (LVF), and severe asthma. These sample sizes are rather inadequate to draw any correlation. Thus the paper by Harrison and colleagues³ does not adequately represent a generalised level of exposure of the individuals to carbon monoxide (CO), nitrogen dioxide (NO₂), and particulate matter (PM₁₀).

In risk assessment of ill health association with air contaminants, uniform sampling of the pollutants at home, school, work, and outdoor activities is important. In a recent article⁴ detailing the effect of the World Trade Center collapse, the authors emphasise that environmental monitoring for exposure assessment is a complex technical task that involves selection of pollutants for monitoring, location of monitors, sample collection methods, risk assessment standards, sampling results, and data analysis. For example, the initial approach to the environmental sampling at the World Trade Center⁴ was to locate monitors at the perimeter of the site, at locations where emergency and debris carrying vehicles were leaving the site, on the debris pile, and at locations in the surrounding community. Additional monitors were set up in the community to ensure a safer environment for workers and students returning to workplaces, homes, and schools. Approximately 66 000 results were entered in a database collected between 11 September and 13 November for subsequent analysis. Substances monitored included asbestos,

particulate matter (PM_{2.5} and PM₁₀), dioxins, polychlorinated biphenyls, CO, heavy metals, and volatile organic compounds (VOCs).

As pointed out by Schneider,⁵ deterministic models are developed from equations based on mathematical principles, while statistical models are developed by fitting to observed data.⁶ In the statistical modelling of inhalation exposure, mixed effect models have been useful. The linear mixed effects model with AR-1 autoregressive correlation structures has recently been used by Levy and colleagues⁷⁻⁹ in their studies.

For example, due to the difficulties in the measurement of personal exposure, data on air pollution patterns in homogeneous microenvironments linked with activity data are often used as surrogates.⁷ In these studies⁷ PM_{2.5} indoor:outdoor ratios were found to be greater than 1 in settings with high levels of human activity. Cooking activities contributed significantly to increases in levels of PM_{2.5} along with other pollutants. Using linear mixed effects models with AR-1 autoregressive correlation structures, 10 minute average outdoor concentrations were generally weak predictors of indoor levels.

As mentioned by Levy and colleagues,⁸ although ambient particulate matter has been associated with ill health, the health risks for individuals depend in part on their daily activities. Information about levels of PM size distributions in indoor and outdoor microenvironments can help identify high risk individuals. The authors used linear mixed effects models with an AR-1 autoregressive correlation structure to evaluate statistical significance of differences between microenvironments. Levels of larger particles were generally higher near significant human activity, and levels of smaller particles were higher near combustion sources. The indoor PM₁₀ concentrations were reported to be significantly higher than those outdoors on buses and trolleys. Statistical models showed significant variability among some indoor microenvironments.

As pointed out by Chang and colleagues,⁹ simulation of activities performed by 65+ year olds indicate substantial variability in personal exposures of PM_{2.5}, O₃, CO, and VOCs over a 12 hour period. For example, one hour personal CO exposures measured in vehicles were significantly higher than those measured in other microenvironments, and the correlation between personal PM_{2.5} exposures and ambient concentrations was lowest in the winter months for indoor non-residential microenvironments and highest in vehicle microenvironments.

Thus the conclusions drawn by Harrison and colleagues³ from the data on a relatively small sample of subjects utilising microenvironment modelling of CO, NO₂, and PM may not adequately reflect the overall exposure patterns. The variance observed between measured and modelled values for PM₁₀ among the elderly, those with COPD, and children could be minimised by taking

measurements in a larger sample, both indoors and outdoors, and during summer and winter months.

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Respiratory effects of volcanic emissions

Although at least 455 million people worldwide live within potential exposure range of a volcano active within recorded history,¹ surprisingly little primary epidemiological research on the health effects of volcanic emissions has been published. The research by Forbes and colleagues² on the respiratory effects of the eruptions in Montserrat is therefore very welcome. However, more studies are needed to determine the transferability of results to volcanic emissions elsewhere. There may be important differences between volcanoes and between events from the same volcano in terms of eruption pattern, gaseous emissions, base composition of ash (for example, cristobalite concentrations), compounds adsorbed onto ash particles (which may be volcanic in origin or derived from other pollution sources), the percentage of particles small enough to be respirable, and toxicological activity.³ For example, most respirable ash in Montserrat has originated from pyroclastic flows, with cristobalite

concentrations measured at 20.1%, but Montserrat ash derived from phreatic explosions has lower cristobalite concentrations (8.6%)⁴ and these are higher than the 4.2% quoted for ash from the United States Mount St Helens eruptions in 1980.⁵ The Soufriere Hills volcano in Montserrat has produced unusually frequent pyroclastic flows, resulting in high exposures to fine ash even in residential areas distant from the volcano, but population exposure to volcanic gases such as sulphur dioxide has been low. This contrasts with volcanoes such as Sakurajima, Japan where frequent ashfalls have been accompanied by SO₂ emissions⁶ or Kilauea, Hawaii where emissions are predominantly SO₂.⁷

Studies of health effects of volcanic ash exposure may help elucidate mechanisms relevant to action of anthropogenic pollution. For example, it remains unclear whether concentration or composition of anthropogenic particulate air pollution is more important for respiratory health effects.⁸ Montserrat children showed increased levels of wheeze and bronchial hyperreactivity following repeated exposures to high concentrations of respirable dust, with increased cristobalite content but low soluble acid content and low *in vitro*⁹ and *in vivo*¹⁰ bioreactivity in toxicological studies. Long term exposure to high levels of cristobalite might be expected to be associated with reductions in lung volumes, not presented in this study, rather than with increased bronchial reactivity. This raises the possibility that the effect of Montserrat ash on bronchial reactivity may have been related to the quantity rather than the quality of the particulates.

Finally, it is unclear whether a peak flow meter or hand held spirometer was used in the Montserrat study. A hand held spirometer is suggested as the ideal measuring tool for field investigations into respiratory effects of volcanic emissions in children. It can be used reliably in children as young as 5 years, and gives a range of readings including FEV₁, which has better baseline reproducibility than peak flow,¹⁰ and lung volumes, which may be particularly useful if follow up studies into long term effects are planned.

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XXVII International Symposium, ISSA Construction: Impact of new demands and global management, Lisbon, Portugal, 22–24 October 2003

The need for continuous improvement of occupational safety and health in the construction industry is a challenge for all construction experts in all countries of the world.

This XXVII Symposium aims to play a fundamental part in the search for this improvement, through debates and discussions on the "Impact of new demands and global management" and to gather all those involved in this important subject.

Thirty international level experts will present their experience. In the course of the seven sessions, enough time will be dedicated to an open and extensive discussion with participants.

A round table will be organised with personalities from the European Union, the USA, Japan, and the ISSA Construction Section, who will provide a forum of exchanges and address health and safety matters regarding their regions and current activities.

Seventy interactive poster presentations will allow direct discussion with the authors.

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NOTICES

The Society of Occupational Medicine Scottish Group, Autumn Meeting, Symposium to mark the retirement of Anthony Seaton, 12 September 2003

The Autumn Meeting of the SOM Scottish Group, "Health and the wider environment: a symposium to mark the retirement of Anthony Seaton" will be held on 12 September 2003 at the Royal College of Physicians, Queen Street, Edinburgh.

Sessions will be chaired by Prof. Anthony Newman Taylor CBE, Prof. Peter Burney, Prof. Robert Maynard, and Prof. Stephen Logan. There will be a valedictory lecture by Prof. Anthony Seaton. The Annual Dinner will be in honour of Prof. Anthony Seaton CBE.