LETTER TO THE EDITOR

ARE TASK-BASED EXPOSURE LEVELS A VALUABLE INDEX OF EXPOSURE FOR EPIDEMIOLOGY?

I read with interest the paper by Nieuwenhuijsen et al. (1995) concerning the exposure levels of airborne dust and aeroallergens in bakeries and similar workplaces. The authors describe a study where personal total inhalable dust samples were obtained during tasks which were "expected to be associated with levels of exposure greater than the shift averages". In total, 31 tasks were identified and 209 samples collected. The work is allied to an epidemiological study of workers in these plants and the implication is that 'peak' exposures, as described by task-based sampling, may be implicated in causing respiratory symptoms.

The reported task geometric mean concentrations varied greatly. The lowest total inhalable dust concentrations were approximately 1 mg m\(^{-3}\) while the highest were around 100 mg m\(^{-3}\). Aeroallergen levels also varied greatly and were correlated with total inhalable dust (Nieuwenhuijsen et al., 1994). The estimated duration of the tasks varied from 2 min up to 4 h, although many tasks were of variable unspecified duration.

It is a weakness of the study that the actual duration of the samples (and tasks) were not reported. In my experience the actual duration of work tasks is never constant but may vary from worker-to-worker and from day-to-day. In other studies (Cherrie et al., 1992) we have observed that there was a negative correlation between task duration and exposure level. Hence, average exposure from a task (that is the average of the product of individual measurements of exposure level and task duration) is not necessarily given by the product of the task average duration and level.

While I recognize the value of task-based exposure assessments in helping to reveal possible causes for variation in full-shift sampling data, I am unconvinced of their value as an exposure metric for epidemiology. Because this type of data is collected over variable time periods there is no guarantee that apparently different measurements could not be produced from similar 'peak' exposure situations, or alternatively, similar measurements arising from different patterns of peaks. For example, a task lasting 50 min with a measured exposure level of 5 mg m\(^{-3}\) could be made up from five short exposures of 10 mg m\(^{-3}\) each lasting 5 min (Fig. 1). Alternatively the same task average data could be composed of one 5 min peak of 50 mg m\(^{-3}\) with no subsequent exposure during the task (Fig. 2). Clearly, if in the later circumstance the duration had been identified as 5 min rather than 50 min, then the average exposure would have been 10 times higher.
Fig. 1.

Fig. 2.
A more appropriate approach to select a metric for 'peak' exposure would be to construct a plausible biological hypothesis linking the exposure under investigation (in this case flour aeroallergen?) and the development of ill health. This hypothesis should indicate an appropriate duration for averaging exposure level, which could be dictated by the half-life for which the agent is active at the target site in the body. It is, however, essential that 'peak' exposure measurements for epidemiological studies are collected over a fixed duration since in the absence of standardization, information on exposure level is meaningless.

The observation made, more than 40 years ago, by Wright (1953) in relation to pneumoconiosis is probably equally valid in other situations. He said "...the present widespread belief in an ill-defined 'peak' hypothesis is not supported by any evidence; it leads to a laborious sampling technique and, if the 'average' hypothesis is correct, may lead to some misdirection of energy in dust suppression."

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REFERENCES