

Letter to the editor

Indoor exposure to formaldehyde and risk of allergy

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Accepted for publication 13 December 1999

The health effects of formaldehyde have been a matter of scientific and particularly allergologic concern for decades. Recently, Garrett et al. proposed that low-level indoor exposure to formaldehyde may increase the risk of sensitization to common aeroallergens in children (1). However, this hypothesis must be critically discussed for several reasons:

- 1) Of the 148 children studied, 33% were exposed to passive smoking. Unfortunately, no exact information is given on the proportion of atopic or asthmatic children in the exposed group. Since tobacco smoke with its numerous volatile compounds may contribute about 50% of indoor formaldehyde levels (2), and may lead to formaldehyde concentrations of up to 2100 ppb (3–5), it would have been helpful to determine whether the confounding factor in the study was: formaldehyde or environmental tobacco smoke. In this context, it is noteworthy that *postnatal* environmental exposure to tobacco smoke in children leads to significant respiratory, but not allergic/atopic, symptoms and morbidity (6–8).
- 2) The highest exposure values to formaldehyde are encountered in occupational settings, but, so far, in this context, formaldehyde has not been proven to

be an important cause of immunologically mediated respiratory disease (9, 10). In addition, an expert panel recently found no evidence that patients could be sensitized by inhalation exposure (11). It was therefore concluded that there is not sufficient evidence to classify formaldehyde as a cause of asthma, according to the official European Union criteria (12). Moreover – and this is a very important finding for this discussion – an indoor level beyond 100 ppb, as reported by Garrett et al. (1), seems to prevent respiratory irritation in exposed persons, a proposed mechanism for sensitization to aeroallergens facilitated by formaldehyde (11).

Unquestionably, the causes of the increasing prevalence of atopic sensitization need to be elucidated. But before far-reaching health risks in the developed world can be attributed to the speculated effects of some indoor pollutants, one should be aware of the numerous pitfalls in finding and interpreting the potential effects of variables affecting the prevalence of atopic disorders (13).

In summary, the presented data are not convincing evidence of an increased risk of atopic allergies in children exposed to low-level indoor formaldehyde.

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Reply

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Accepted for publication 13 December 1999

We thank Drs Kränke and Aberer for their interest in our study. Passive smoking is highly unlikely to have confounded the results. It is true that smoking is an indoor source of formaldehyde, although not a significant one in our study. Presence of fibreboard, particleboard flooring, house age, and indoor temperatures were the only significant predictors of formaldehyde levels. As shown by our original paper (1), which was cited, it would be almost impossible for tobacco smoking to have caused the associations seen between formaldehyde levels and atopy. Kränke and Aberer themselves note that passive smoking is not associated with the outcomes of interest; i.e., atopy and asthma. To be a confounder, a factor must not only be associated with the exposure, but must also cause the outcome in its own right.

The relevance of occupational exposure to formaldehyde is questionable. We would concede that it is probably not a major cause of occupational asthma. However, the epidemiologic studies that have been conducted in adults are biased by the well-known “healthy worker” effect. The occupational exposure

limit of 300 ppb applies to the time-weighted average over an 8-h shift. The duration of sampling in our study was 4 days. Paustenbach et al. (2) actually recommended that an indoor level *below* (not above) 100 ppb should prevent irritation. Levels above 100 ppb were in fact detected in some homes.

However, it is also quite possible that formaldehyde does cause sensitization to common aeroallergens by some mechanism not involving respiratory irritation. For example, many formaldehyde compounds are well-recognized skin sensitizers (3). Furthermore, one probably does not need to be aware of respiratory irritation for the combination of aeroallergens and formaldehyde to have an effect on the immune system. This may be particularly relevant in children whose immune systems are still developing.

Of course, the speculation that formaldehyde may increase the risk of allergic sensitization in children remains unproven. Our paper aimed to suggest that this could be the case. We contend that this hypothesis is supported by our observations and those of Wantke et al. (4) in children and Wieslander et al. (5) in young adults.

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In summary, we agree that our data do not conclusively prove that an increased risk of atopic disease in children is due to low-level indoor formaldehyde exposure.

However, we do believe that our data raise a hypothesis that may have been overlooked and that should be further tested before being dismissed as false.

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