



COMMITTEE ON THE MEDICAL EFFECTS OF AIR POLLUTANTS

STATEMENT ON ASTHMA AND EXPOSURE TO CHLORINE AND ASSOCIATED REACTION PRODUCTS AT SWIMMING POOLS

Summary

1. The Pool Water Treatment Advisory Group (PWTAG) has requested an updated view from COMEAP on whether using chlorinated swimming pools poses a risk of developing asthma. Recent advances in the scientific understanding of how asthma develops suggest that such a link might be plausible. However, epidemiological (population) studies of recreational swimmers provide less support for the idea that swimming in chlorinated pools can result in new cases of asthma than was the case when COMEAP last reviewed the available data in 2007. Nonetheless, we reiterate the Committee's existing advice that management of swimming pools should keep levels of chlorination by-products as low as is consistent with adequate disinfection.

Background

2. It has been suggested that use of chlorinated swimming pools could cause some individuals to develop asthma. Trichloramine, or other irritant by-products of disinfection of pool water with chlorine, have been suggested as possibly causing such an effect. Many of the studies investigating this hypothesis have focussed on the use of swimming pools in childhood or by infants.

3. The Committee considered the possible role of exposure to chlorine and chlorination by-products at swimming pools in the development of asthma in 2003 and 2007. In 2007, Members agreed that the evidence was "suggestive of an association between the use of indoor (chlorinated) swimming pools and levels of childhood asthma. Members felt that the evidence was insufficient to give strong support to the idea that the use of indoor swimming pools *causes* healthy children to become asthmatic. Members agreed that the likelihood of the use of indoor (chlorinated) swimming pools being a major cause of the high levels of childhood asthma in the UK was low."

Members' views

4. We have reviewed new studies published since the Committee's last consideration of this issue. These papers are summarised in the discussion paper [COMEAP/2011/04](#) and include:

- A study of occupational exposures in swimming pools
- Studies in elite swimmers

- Studies in adult swimmers
- Prevalence studies in children and adolescents
- Prevalence studies of “baby swimming”
- Cohort studies in children and of “baby swimming.”

5. We discussed the findings of these studies at a meeting in July 2011, considered a draft statement in October 2011 and agreed this statement in April 2012. Points raised during the discussions can be found in the minutes of these meetings: [COMEAP/2011/MIN2](#) and [COMEAP/2011/MIN3](#) and COMEAP/2012/MIN1. Our evaluation focussed on the possible risks posed by the recreational use of chlorinated swimming pools.

6. The results from cross-sectional studies are mixed. Although many report associations of asthma with use of chlorinated swimming pools, particularly in atopic individuals (those with a tendency to show allergic responses), others did not find an increased risk of asthma or respiratory allergy to be associated with swimming in chlorinated pools.

7. We place more weight on the evidence from longitudinal studies (in which individuals have been followed over a period of time), as this study design is better suited to testing hypotheses regarding causality. Of the three cohort studies available, two showed negative associations with asthma (i.e. a reduced risk of asthma in those with higher use of chlorinated pools). The third found an association with wheeze in infants (under 2 years old) of atopic mothers. The lack of a clear link between wheeze in pre-school children and atopic asthma makes it difficult to interpret what this finding might imply about the likelihood of these individuals developing atopic asthma in later childhood.

8. We note that exposures to chemicals associated with chlorinated swimming pools have not been well characterised in the epidemiological investigations, including the cohort studies, and this is an important limitation of the current evidence base.

9. Overall, we consider that the epidemiological evidence provides less support for the suggestion that recreational swimming causes the development of new asthma than was the case when COMEAP last commented on this issue in 2007.

10. In contrast, the evidence for plausible mechanisms by which irritant disinfection by-products (such as chloramines in swimming pools) could cause asthma has increased, particularly given the current understanding of the role of the airway epithelium in the development of asthma. We note that development of eczema was associated with swimming pool use in one study; this is relevant given the understanding that, like asthma, eczema involves a breakdown in the barrier function of the epithelium.

11. Our evaluation has focussed on the public health implications of recreational swimming rather than potential effects on elite swimmers. The studies on elite swimmers that we reviewed suggest that some characteristics of the airways of elite swimmers are different from those in the general population. We have not evaluated the extent to which such differences might be attributed to the use of chlorinated swimming pools, nor their implications for the likelihood of developing asthma.

Conclusions

12. Whilst the new mechanistic evidence reinforces the biological plausibility of a causal relationship in initiating new asthma in individuals who previously had not experienced the disorder, we are of the overall view that the epidemiological evidence linking recreational swimming to asthma is now less suggestive of a causal association than was the case in 2007.

13. Nonetheless, we reiterate the Committee's previous advice that management of swimming pools should keep levels of disinfection by-products as low as is consistent with adequate anti-microbial activity.

Recommendations for further work

14. We make a number of suggestions for further analyses of the existing data that would be helpful:

- A systematic identification of relevant epidemiological studies followed by statistical analysis to summarise (meta-analyse) the results and investigate reasons for the variation between studies and the possibility of publication bias (funnel plots).
- A comprehensive systematic review and synthesis of the evidence on possible mechanisms.

15. We would also like to see:

- Epidemiological investigations which include better characterisation of exposures to chemicals associated with chlorinated swimming pools.
- Additional cohort studies, preferably prospective.
- Information on the health benefits of swimming that could be used to compare with possible risks.
- Data on concentrations of disinfection by-products in the atmospheres of UK pools.

16. In particular, we recommend that the new UK Birth Cohort Study should include the collection of data suitable for investigating possible associations between the use of chlorinated swimming pools and the initiation of new cases of childhood asthma.

**COMEAP
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