


# Respiratory and Allergic Health Effects of Dampness, Mold, and Dampness-Related Agents: A Review of the Epidemiologic Evidence

[The original paper](#)  contains 20 sections, with 6 passages identified by our machine learning algorithms as central to this paper.

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## Paper Summary

SUMMARY PASSAGE 1

### Section 1

volume 119 | number 6 | June 2011 • Environmental Health Perspectives Review Dampness and mold exposures in buildings are common, with estimates ranging from 18% to 50% of buildings (Gunnbjornsdottir et al. 2006; Mudarri and Fisk 2007). A large number of studies in many geographical regions have found consistent associations between evident indoor dampness or mold and respiratory or allergic health effects in infants, children, and adults [Institute of Medicine (IOM) 2004; World Health Organization (WHO) Europe 2009]. A review by the IOM (2004) reported documented associations, but not documented causal relationships, between indoor dampness and upper respiratory tract symptoms, cough, wheeze, and asthma symptoms in sensitized persons, but not for asthma development.

## SUMMARY PASSAGE 2

### Methods

Each study generally reported multiple findings (for example, four findings from a study reporting estimates for associations between visible dampness and daytime wheeze, visible dampness and nighttime wheeze, mold odor and daytime wheeze, and mold odor and nighttime wheeze). Based on all currently available evidence, including studies reviewed in the IOM report, new studies included in this review, and findings from available quantitative metaanalyses, we drew conclusions about associations between specific health outcomes and qualitatively assessed dampness or mold (excluding quantitative assessments of microbiologic factors). In "Results," we generally refer to all ratio estimates of effect as odds ratios (ORs), although a few studies used other types of ratio estimates.

## SUMMARY PASSAGE 3

### Iom Review.

Findings, summarized in Table 2, are described for specific outcomes below. Two metaanalyses using the same methods estimated summary ORs and 95% CIs for associations of dampness or mold in residences with respiratory effects: upper respiratory tract symptoms, cough, wheeze, asthma development, current asthma, and everdiagnosed asthma, and respiratory infections and bronchitis (Fisk et al. 2010). Antova et al. (2008) estimated summary ORs for dampness-related factors and everdiagnosed asthma, bronchitis, allergic sensitization, hay fever, cough, and wheeze.

#### SUMMARY PASSAGE 4

## Discussion

Epidemiologic evidence from primary studies and quantitative metaanalyses shows evident indoor dampness or mold to be associated consistently with a wide range of respiratory or allergic health effects, including asthma development and exacerbation, current and ever diagnosis of asthma, dyspnea, wheeze, cough, respiratory infections, bronchitis, allergic rhinitis, eczema, and upper respiratory tract symptoms. In addition to the consistently positive associations across many study designs, populations, ages, and health outcomes, dose-response relations with observed dampness and mold were often reported (e.g., Biagini et al. 2006; Cummings et al. 2008; Park et al. 2004; Lossifova et al. 2007; Lossifova et al., 2009; Park et al. 2001; Park et al., 2006; Zhao et al. 2008; Schram-Bijkerk et al. 2005; Bolte et al. 2003; Campo et al. 2006; Douwes et al. 2006; Gehring et al. 2008; Gillespie et al. 2006; Litonjua et al. 2002; Perzanowski et al. 2006).  $1 \times 10^{-3}$   $\beta$ -D-glucans in dust, medium levels Wheeze 7 of 8 (88%) 3 0.89-6.05 Douwes et al. 2006; Lossifova et al. 2007; Lossifova et al., 2009.  $10^{-2}$ -D-glucans in dust, highest levels Wheeze 10 of 11 (91%) 4 0-1.25 Douwes et al. 2006; Lossifova et al. 2007; Lossifova et al., 2009; Schram-Bijkerk et al. 2005. A suggestive association required, among reported findings on associations between a specific measured indoor microbiologic factor and a specific respiratory or allergic health outcome, at least 80% consistency of estimates either  $\geq 1.0$  or  $> 1.0$ , among at least five estimates available from three or more studies. This assessment did not consider magnitude of effects, precision, statistical significance, study design, or age of subjects.

#### SUMMARY PASSAGE 5

## Evidence For Plausible Biologic Mechanisms Of Health Effects From Dampness-Related Agents.

The hygiene hypothesis. As summarized in this review, indoor dampness or mold is consistently associated with increased respiratory health risks, and microbial exposures have been suggested (but not proven) to play a causal role. On the other hand, an increasing number of studies suggest that early-life microbiologic exposures to endotoxin or specific fungal agents may protect against atopy and allergic disease.

## Conclusion

Based on available evidence, the presence of dampness, water damage, visible mold or mold odors or a history of water damage provides more reliable indicators of dampness or mold-related health risks than do current quantitative microbiologic assessments. As reduction of indoor dampness and mold is likely to have benefits for respiratory and allergic health of occupants, this level of knowledge should guide practical prevention and remediation now. Still, available research does not yet indicate the amount of water damage, mold, or mold odor meriting concern nor document the relative magnitude of health benefits from different environmental remediations.