Recently Published Evaluations of the Association of Mycotoxins and Health Effects in Indoor Environments

Bryan D. Hardin, PhD, Fellow ATS

BHardin@Veritox.com

VERITOX

Toxicology and Industrial Hygiene

Opinions of "Authoritative Bodies"

- 2002 American College of Occupational and Environmental Medicine (ACOEM)
- 2004 Institute of Medicine (IOM)
- 2006 American Academy of Allergy, Asthma, and Immunology (AAAAI)
- 2006 American College of Medical Toxicology (ACMT)

Modes of Fungal-Induced Adverse Health Effects

- Allergy
- Infection
- Toxicity

Allergy

- Immediate hypersensitivity (e.g., “hay fever”)
  - Sensitized individuals respond to low levels
  - Susceptible individuals tend to be reactive to many allergens (e.g., animal dander, pollens, dust mites)
- Hypersensitivity pneumonitis (Allergic alveolitis)
  - Requires exposure to very high level of allergen
  - Usually occupational (also pet birds and humidifiers)
- Uncommon conditions
  - Allergic Bronchopulmonary Aspergillosis (ABPA)
  - Allergic Fungal Sinusitis (AFS)

Infection (Mycosis)

- Superficial skin infections are common, e.g., athlete's foot, ring-worm
- A few fungi cause non-superficial infections in healthy persons: *Blastomyces, Coccidioides, Cryptococcus, Histoplasma*
- Severely immune-compromised individuals are at risk of opportunistic fungal infections

Toxicity (Mycotoxicosis)

- Disease or illness caused by toxic chemicals (mycotoxins) produced by fungi

- Historical examples
  - *Claviceps purpurea* (ergot alkaloids):
    - Ergotism; St. Anthony's Fire
  - *Fusarium* (fumonisins)
    - Veterinary disorders, alimentary toxic aleukia (ATA)
  - *Stachybotrys* (trichothecenes)
    - Stachybotryotoxicosis; oral & GI hemorrhage

ACOEM
Evidence-Based Statement

Adverse Human Health Effects Associated with Molds in the Indoor Environment

Online November 2002

Journal of Occupational and Environmental Medicine, 45(5):470-478, 2003

ACOEM Conclusions

- Mold is likely to sensitize and produce allergic responses in allergic individuals
- Except for persons with severely impaired immune systems, indoor mold is not a source of fungal infections
- Current scientific evidence does not support the proposition that human health has been adversely affected by inhaled mycotoxins in the home, school, or office environment

Conclusions

Toxicity	Infection	Allergy
No	No	Yes

Institute of Medicine (IOM)

Committee on Damp Indoor Spaces and Health: Damp Indoor Spaces and Health. Washington, DC. National Academy Press, 2004.

IOM Evidence Categories

BOX ES-1
Summary of the Categories of Evidence Used in This Report

Sufficient Evidence of a Causal Relationship

Evidence is sufficient to conclude that a causal relationship exists between the agent and the outcome. That is, the evidence fulfills the criteria for "sufficient evidence of an association" and, in addition, satisfies the following criteria: strength of association, biologic gradient, consistency of association, biologic plausibility and coherence, and temporally correct association.

Sufficient Evidence of an Association

Evidence is sufficient to conclude that there is an association. That is, an association between the agent and the outcome has been observed in studies in which chance, bias, and confounding can be ruled out with reasonable confidence.

Limited or Suggestive Evidence of an Association

Evidence is suggestive of an association between the agent and the outcome but is limited because chance, bias, and confounding cannot be ruled out with confidence.

Inadequate or Insufficient Evidence to Determine Whether an Association Exists

The available studies are of insufficient quality, consistency, or statistical power to permit a conclusion regarding the presence of an association. Alternatively, no studies exist that examine the relationship.

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Association Exists

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IOM Outcomes - Dampness

TABLE ES-1 Summary of Findings Regarding the Association Between Health Outcomes and Exposure to Damp Indoor Environments[a]

Sufficient Evidence of a Causal Relationship

(no outcomes met this definition)

Sufficient Evidence of an Association

Upper respiratory (nasal and throat) tract symptoms
Cough
Wheeze
Asthma symptoms in sensitized asthmatic persons

Limited or Suggestive Evidence of an Association

Dyspnea (shortness of breath)
Lower respiratory illness in otherwise-healthy children
Asthma development

Inadequate or Insufficient Evidence to Determine Whether an Association Exists

Airflow obstruction (in otherwise-healthy persons)
Mucous membrane irritation syndrome
Chronic obstructive pulmonary disease
Inhalation fevers (nonoccupational exposures)
Lower respiratory illness in otherwise-healthy adults
Acute idiopathic pulmonary hemorrhage in infants
Skin symptoms
Gastrointestinal tract problems
Fatigue
Neuropsychiatric symptoms
Cancer
Reproductive effects
Rheumatologic and other immune diseases

[a]These conclusions are not applicable to immunocompromised persons, who are at increased risk for fungal colonization or opportunistic infections.

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Inadequate or Insufficient Evidence to Determine Whether an Association Exists

Airflow obstruction (in otherwise-healthy persons)	Skin symptoms
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IOM Outcomes - Mold

TABLE ES-2 Summary of Findings Regarding the Association Between Health Outcomes and the Presence of Mold or Other Agents in Damp Indoor Environments[a]

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[b]For mold or bacteria in damp indoor environments.

IOM Conclusions

Evidence was judged:

- Insufficient to support a causal relationship for any of 21 conditions
- At least suggestive of an association for 6 of 21 conditions
- Insufficient to determine whether an association exists for 15 of 21 conditions

Conclusions

	Toxicity	Infection	Allergy
ACOEM	No	No	Yes
IOM	No	No	Yes

AMERICAN ACADEMY OF ALLERGY ASTHMA & IMMUNOLOGY

AAAAI Position Paper

Position paper of the American Academy of Allergy, Asthma, and Immunology

Bush RK, et al. 2006. The medical effects of mold exposure. *Journal of Allergy and Clinical Immunology*, 117(2):326-333.

AMERICAN ACADEMY OF ALLERGY ASTHMA & IMMUNOLOGY

AAAAI: Issues

- Allergy and Asthma
- Allergic Bronchopulmonary Aspergillosis and Sinusitis
- Hypersensitivity pneumonitis
- Infection
- Toxicity
- Irritation
- Immune Dysfunction
- Laboratory Assessment
- Environmental Sampling

AMERICAN ACADEMY OF ALLERGY ASTHMA & IMMUNOLOGY

AAAAI: Sampling the Environment

- Sampling can be useful in certain clinical conditions, but it has many shortcomings
- Bulk, surface, and within-wall cavity measurement for molds or mycotoxins, cannot be used to assess exposure

AMERICAN ACADEMY OF ALLERGY ASTHMA & IMMUNOLOGY

AAAAI: Allergy, and Asthma

- Lower airway disease (e.g., asthma)
  - Allergic responses to inhaled mold antigens are a recognized factor
- Upper airway allergy (e.g., allergic rhinitis)
  - Evidence is not conclusive that outdoor or indoor airborne molds play a role
- Atopic dermatitis, urticaria, angioedema, anaphalaxis
  - Airborne mold is not recognized as a contributing factor

AMERICAN ACADEMY OF ALLERGY ASTHMA & IMMUNOLOGY

AAAAI: Immune Dysfunction

- Immune dysregulation (e.g., immunodeficiency or autoimmunity)
  - Not induced by molds and their products
- The practice of performing large numbers of nonspecific immune-based tests as an indication of mold exposure or mold-related illness is not evidence based and is to be discouraged.

AMERICAN ACADEMY OF ALLERGY ASTHMA & IMMUNOLOGY

AAAAI: *Infection*

- Superficial fungal infections
  - Determined by local skin barrier, resident microflora, or both
- Aggressive fungal pathogens
  - Limited In number, acquired through specific outdoor exposures
- Opportunistic fungal infections
  - Host factors are the main determinant, not environmental exposure

AMERICAN ACADEMY OF ALLERGY ASTHMA & IMMUNOLOGY

AAAAI: Toxicity

- Mold-related toxicity (mycotoxicosis) from exposure to inhaled mycotoxins in non-occupational settings
  - Improbable
  - Occurrence is not supported by current data
- We agree with the [ACOEM] evidence-based statement and the [IOM] … that the evidence does not support the contention that mycotoxin-mediated disease (mycotoxicosis) occurs through inhalation in non-occupational settings

Conclusions

Toxicity	Infection	Allergy
No	No	Yes
No	No	Yes
No	No	Yes

ACMT Comment on IOM Report

American College of Medical Toxicology Practice Committee

Sudakin D and Kurt T. 2006. American College of Medical Toxicology Comment: Institute of Medicine Report on Damp Indoor Spaces and Health.
https://www.acmt.net/main/page.asp?pageid=194

ACMT Conclusions

- Concurs with IOM assessment of the relationship between damp indoor spaces and human health effects
- Recommends that responses to damp indoor spaces be based generally accepted associations with allergic disease

ACMT Conclusions

- Responses should not be solely based upon the presence of fungi or mycotoxins
- Scientific evidence does not provide any compelling data to conclude that they pose significant health risks via inhalation indoors
- Risks from inhalation exposure are minimal

ACMT Conclusions

The use of unapproved diagnostic studies and therapeutic modalities based on unproven infection or mold-related toxicity (as opposed to allergic phenomena) are medically inappropriate and costly

Conclusions

Toxicity	Infection	Allergy
No	No	Yes
No	No	Yes
No	No	Yes
No	not evaluated	not evaluated

Conclusion

- Four major scientific / medical organizations reviewed evidence
- Statements reflect progressive accumulation of new data over a 4-year interval
- All statements agree that exposure to mold in indoor environments is:
  - Known to exacerbate allergies
  - Not known to cause infection
  - Not known to cause toxic responses

Contact Information

Bryan Hardin, PhD, Fellow ATS
Principal

Veritox
18372 Redmond-Fall City Rd.
Redmond, WA 98052
425-556-5555

bhardin@veritox.com
www.veritox.com