

Mold for Health Care Providers



This fact sheet pertains to environmental exposure to mold (fungi) and does not apply to an infection/tissue invasion with any type of fungal species.

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Mold Growth

Fungal spores are always present in the air, even if there is no visible growth

Three factors are necessary for growth:

- **Moisture**
Different fungal species will grow with different amounts of moisture (damp windows versus leaking pipe versus flood waters in house), usually on material with a moisture content above 16%.
 - For example, *Aspergillus* and *Penicillium* tend to grow with damp conditions (minor moisture/condensate), while *Stachybotrys*, *Fusarium*, and *Acremonium* are hydrophilic molds and will only grow with higher amounts of moisture present.
 - Moisture indoors may also provide a climate for bacteria, cockroaches, and dust mites (all may be a problem for people).
- **Nutrients**
Almost anything can be a food source for mold, including dirt, dust, wood, paper, paint, glue, textiles, insulation, and other common materials.
 - For example, *Stachybotrys* will grow on cellulose-containing materials, such as wallpaper, paper, gypsum of wallboard, ceiling tiles, carpets, and insulation (e.g. urea-formaldehyde foam).
- **Temperature**
If the other two factors are present, fungi will grow at any temperature between 32°F and 130°F.

What mold structure and chemicals have been linked to health effects?

Exposure, in general, may be from:

- dermal contact
- inhalation
- ingestion

People may be exposed to three different mold products:

- **Spores**

Most mold spores are respirable (2 to 10 μm); however, some are greater than respirable size (100 μm).

- Typically, particles between 2 and 10 μm are able to reach the lungs, while particles between 10 and 100 μm may only make it to the bronchi and bronchioles.

- **Fungal fragments**

Many fungal fragments have structural chemicals that may cause allergic or irritant reactions:

- Glucans (structural component present in cell walls)
- Ergosterol (structural component present in the cell membrane)

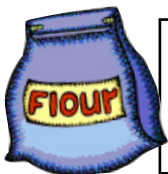
- **Chemicals produced by fungal species**

Mold growing indoors can degrade the surrounding materials and add chemicals and bioaerosols to indoor air.

- The musty smell that is often present with mold growth is from volatile organic chemicals (VOCs).
 - VOCs include alcohols, esters, aldehydes, hydrocarbons, and aromatic compounds.
 - VOCs are irritating in higher concentrations (may cause eye irritation, conjunctivitis, skin rashes, rhinitis, laryngitis, hoarseness, cough, and chest tightness).
- When conditions are appropriate, fungal species may produce mycotoxins (secondary metabolites) that are toxic to humans and animals.
 - Mycotoxins may be present in spores and fungal fragments.
 - Amount of mycotoxins can vary with specific isolate and prevailing growth conditions (temperature, nutritive status, light level, growth phase).



Note: Exposure to any of these three mold products may not necessarily cause health effects.



Mycotoxins can also be present in food, water and dietary supplements (e.g. aflatoxin, deoxynivalenol, patulin, ochratoxin, and fumonisins).

The U.S. Food and Drug Administration (FDA) regulates mycotoxins in food.

Health effects that are linked to mold and its chemicals:

Health effects associated with exposure to indoor mold:

- upper respiratory tract symptoms, including nasal congestion, sneezing, runny or itchy nose, and throat irritation
- exacerbation of pre-existing asthma
- wheeze
- cough
- hypersensitivity pneumonitis in susceptible persons
- fungal colonization or opportunistic infections in immune-compromised persons

Health effects associated with agricultural/gardening products and dusts:

- Organic dust toxic syndrome, due to inhalation of dust containing organic material (mold/bacteria) primarily in, but not limited to, agricultural and demolition settings.
- Hypersensitivity pneumonitis, from exposure to moldy straw, hay, compost and mulches.

Damp environments in general have been linked to:

- respiratory symptoms
- headache
- fatigue
- recurrent infections



Note: The suspected causes of these symptoms are not limited to mold. Other organisms such as dust mites and bacteria may also be responsible. Bacteria can also grow indoors and may produce endotoxins and bacterial VOCs.

Health effects not associated with mold:

Certain health conditions do not have sufficient evidence to be associated with indoor mold. Insufficient evidence could be due to lack of published studies or limitations in study designs.

These health conditions are:

- acute idiopathic pulmonary hemorrhage in infants
- cancer
- development of asthma¹
- gastrointestinal tract problems²
- lower respiratory illness in otherwise-healthy adults
- mucous membrane irritation syndrome
- neuropsychiatric symptoms (including loss of intellectual ability, sleepiness in school)
- rheumatologic and other immune diseases
- airflow obstruction in otherwise-healthy persons
- chronic obstructive pulmonary disease
- fatigue
- inhalation fevers not related to occupational exposures (hypersensitivity pneumonitis symptoms)
- reproductive effects
- shortness of breath¹
- skin symptoms²

¹ Mold exposure may trigger asthma (Mazur et al. 2009).

² Ingestion of mycotoxins through food has been linked to gastrointestinal problems and direct contact with specific mycotoxins or VOCs may irritate the skin (Mazur et al. 2009).

Should I recommend mold testing?

No.

The genus or species of the mold does not matter in most environmental exposures. Also, there are no regulatory or health-based levels to compare to results. “Safe” or “dangerous” levels of mold have not been set.

It is not a problem for mold spores to be present in indoor environments, however, mold growth indoors is a problem. Mold testing counts the viable mold spores present, it does not tell if mold is actively growing in the room. It also does not measure the fungal fragments when they are not viable.

As outside air enters a house, so will mold spores (amount and type of spores would be similar). The patient’s focus should be on addressing both the cause of the mold growth and the mold itself, not identification or presence of mold spores.

Refer patients to MDCH’s mold education series, including:

- *All About Mold* (basic)
- *Steps for Cleaning Mold*
- *Mold & Your Health*
- *Mold & Renter Disputes*
- *Mold & Home Owners*



Note: Testing to determine if a person is infected with a fungal species is beyond the scope of this fact sheet.

What if my patients already tested their home for mold and have results?

There are no standards for levels of mold/mold spores in an indoor environment. If mold can be detected, either visually or by odor, it should be addressed. Action is not dependent on amount of spores present.

If the patient has mold testing results, here are a few items to consider:

- **Did the testing company use an industrial hygienist?**
 - Industrial hygienists have the background to deal with indoor air situations. The individuals should have accreditation (Certified Industrial Hygienist [CIH] or Certified Associate Industrial Hygienist [CAIH]) from the American Board of Industrial Hygiene (ABIH). Many other “certifications” are available, but not all require the same level of technical expertise.
- **Air sample results:**
 - Number of colony forming units per cubic meter of air (CFU/ m³) indicate the number of colonies that grew on media from air in a specific location
 - The results should have both indoor and outdoor (reference area) samples for comparison. If the outdoor levels are greater than the indoor levels, there may not be an indoor mold problem.



- **Human blood testing results:**

- The companies that test blood for mold and mycotoxins typically use testing for antibodies against mold or mycotoxins (RAST, ELISA). This has all the limitations of typical allergy testing and the American College of Medical Toxicologists states that it “is not an accepted method to assess human exposure.”
- Results from the testing are not able to assess human exposure as the testing is based on encountered antigen (extract); the antibodies an individual has, which is not diagnostic of disease; and there is no connection between mold in the home and presence of antibodies to either mycotoxins or mold (a variety of mycotoxins are present in food and people can be exposed to mold through a variety of activities).
- Companies do not appear to test for infections with fungal species or the presence of mycotoxins. These items may not be clear due to the wording used to report out the test results.

What about “toxic black mold”?

According to the US Centers for Disease Control and Prevention (CDC), the term “toxic mold” is not correct. While certain molds are toxigenic, meaning they can produce poisons (called mycotoxins), the molds themselves are not toxic or poisonous. The “toxic black mold” often linked to issues in popular media reports is *Stachybotrys chartarum*.



Facts:

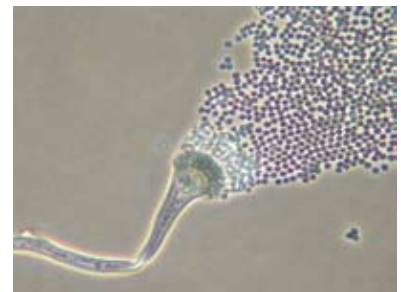
- Many molds are black in appearance; color does not indicate species (some fungal species will have different colors under different growth conditions).
- Even if *Stachybotrys* is growing in a person’s house that does not mean it is producing dangerous levels of mycotoxins. (And again, we do not recommend testing in the first place.)
- Presence and amount of mycotoxins can vary with specific isolate and prevailing growth conditions (temperature, nutritive status, light level, growth phase).



multi-colored mold growing on a wall



mold growing in petri dishes



release of mold spores - magnified

Is more information available?

Yes, see the next page for additional references. You can also contact the Michigan Department of Community Health at 1-800-648-6942 or visit www.michigan.gov/mold.



Additional References on Mold Exposure

Burch B, Svendsen E, Siegel PD, Wagner SE, von Essen S, Keefe T. 2010. Endotoxin Exposure and Inflammation Markers Among Agricultural Workers in Colorado and Nebraska. *J Toxicol Environ Health A*. 73:5–22.

Dillon HK, Miller JD, Sorenson WG, Douwes Jeroen, and Jacobs RR. 1999. Review of Methods Applicable to the Assessment of Mold Exposure to Children. *Environ Health Perspect*. 107: 473-480.

Kurt TL and Sudakin DL. 2007. Institute of Medicine Report on Damp Indoor Spaces and Health Position Statement from the American College of Medical Toxicologists. http://www.acmt.net/cgi/page.cgi?aid=12&_id=52&zine=show

Mazur LJ, Kim J, the Committee on Environmental Health. 2006 Spectrum of Noninfectious Health Effects from Molds. *Pediatrics* 118: e1909-e1926.

Storey E, Dangman KH, Schenck P, DeBernardo RL, Yang CS, Bracker A, Hodgson MJ. 2004. Guidance for Clinicians on the Recognition and Management of Health Effects Related to Mold Exposure and Moisture Indoors. <http://oehc.uchc.edu/images/PDFs/MOLD%20GUIDE.pdf>

United States Government Accountability Office. 2008. Indoor Mold: Better Coordination of Research on Health Effects and More Consistent Guidance Would Improve Federal Efforts. GAO-08-980. <http://www.gao.gov/new.items/d08980.pdf>