Haines SR, Siegel JA, Dannemiller KC. 2020. Modeling microbial growth in carpet dust exposed to diurnal variations in relative humidity using the "time-of-wetness". *Indoor Air*, **30(5)**, 978-992.
DOI: 10.1111/ina.12686

Abstract

Resuspension of microbes in floor dust and subsequent inhalation by human occupants is an important source of human microbial exposure. Microbes in carpet dust grow at elevated levels of relative humidity, but rates of this growth are not well established, especially under changing conditions. The goal of this study was to model fungal growth in carpet dust based on indoor diurnal variations in relative humidity utilizing the time-of-wetness framework. A chamber study was conducted on carpet and dust collected from 19 homes in Ohio, USA and exposed to varying moisture conditions of 50%, 85%, and 100% relative humidity. Fungal growth followed the two activation regime model, while bacterial growth could not be evaluated using the framework. Collection site was a stronger driver of species composition (P = 0.001, R^2 = 0.461) than moisture conditions (P = 0.001, R^2 = 0.021). Maximum moisture condition was associated with species composition within some individual sites (P = 0.001-0.02, R^2 = 0.1-0.33). *Aspergillus, Penicillium, and Wallemia* were common fungal genera found among samples at elevated moisture conditions. These findings can inform future studies of associations between dampness/mold in homes and health outcomes and allow for prediction of microbial growth in the indoor environment.

Practical Implications

- Exposure to mold in housing costs society billions of dollars every year and can originate from fungal growth in **carpet dust** when relative humidity in the air is **elevated**.
- Utilization of the time-of-wetness framework allowed for improved prediction of human exposure at both the individual and population level.
- The data indicate that site of sampling is a stronger driver of microbial communities in dust than moisture effects, which has implications for detection of undesirable microbial growth in buildings.
- This work allows for accurate modeling of fungal growth in carpet dust upon exposure to elevated relative humidity, and also emphasizes the difficulty of detecting the presence of indoor mold growth using available methods.

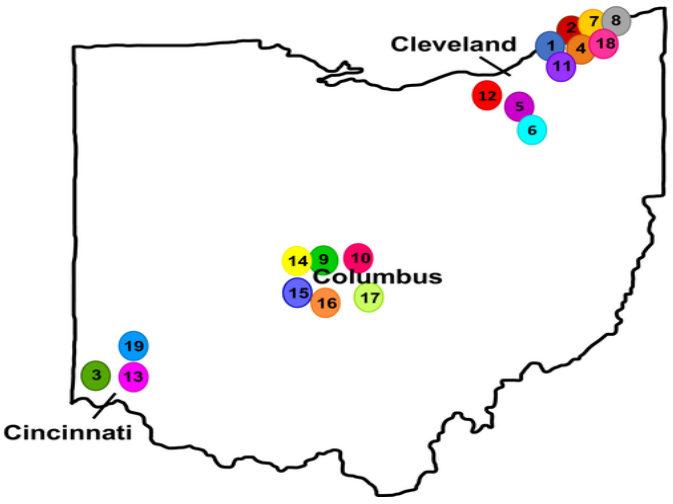

Figure 2 Map of Ohio showing each of the 19 locations for carpet and dust collection.

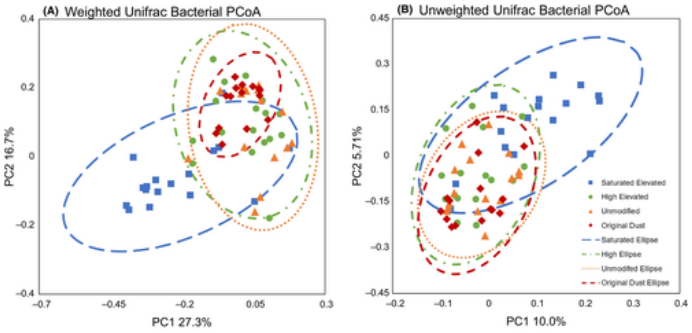

Figure 7 Weighted and Unweighted Unifrac for bacterial PCoA analysis showing day 14 samples from each of the 19 sites at a constant elevated moisture condition of either Saturated, High, or Unmodified. A 95% confidence ellipse was added for each condition to show comparison. PCoA = principle component analysis.

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