Indoor fungal contamination: Health risks and measurement methods in hospitals, homes and workplaces

Paper Summary

SUMMARY PASSAGE 1

Introduction

To deal with the complexity of the diverse effects of mold on health, many measurement strategies have been developed to assess indoor fungal contamination. Although hospitals are very different from home and agricultural environments (in terms of fungal contamination and biodiversity), there may be similarities in sampling and analysis methods. In this article, an overview is provided on the health effects associated with fungal exposure in these three environments.

SUMMARY PASSAGE 2

Control Of Fungal Environmental Risk In Hospitals

Fungal infections are a public health issue in hospitals. Aspergillosis is the most significant opportunistic disease in immunocompromised patients: this fungal infection is caused primarily by Aspergillus fumigatus, but also to a less degree by Aspergillus flavus, Aspergillus nidulans, Aspergillus niger and Aspergillus terreus (Garcia-Vidal et al., 2008;Perfect et al., 2001). Other fungi causing respiratory infections include Acremonium, Paecilomyces, Rhizopus, Mucor, Absidia and Fusarium (Fleming et al., 2002;Lanternier et al., 2012).

SUMMARY PASSAGE 3

Assessment Of The Fungal Risk In The Workplace

Indoor fungal contamination is a public health concern that may affect various populations (patients, residents, workers) depending on the context and the individual susceptibility. There are many adverse health effects with differing degrees of severity, and the development of some diseases is known to be associated with specific molds. Fungal concentration and diversity depend on the specific characteristics of the indoor environment and so the aim of sampling for fungi may vary, as well as the techniques used to detect fungal contamination.

SUMMARY PASSAGE 4

Environmental Sampling Techniques

The main reason for collecting samples when fungal contamination is suspected is to detect, quantify and identify any fungi that might be present (Portnoy et al., 2004). Before starting a survey, certain essential factors should be established and evaluated: the reasons for undertaking the inspection, the types of fungi being looked for, the sampling frequency and the places to be sampled. In hospitals, samples are usually taken in areas with air-treatment systems where the presumed level of aerobiocontamination is very low (such as wards with high efficiency filtration and operating rooms) (Gangneux et al., 2002).

SUMMARY PASSAGE 5

Dust Sampling

Dust can be analyzed to determine the presence of fungi or fungal agents that have accumulated over time, as it provides an indication of the microbial agents that may have been airborne (Table 2). The term "settled dust" is often used to (2011) Lpm, liters per minute; C, cellulose membrane; G, gelatine membrane; GF, glass fiber filter; MCE, mixed cellulose ester filter; P, polycarbonate filter; T, teflon filter.

SUMMARY PASSAGE 6

Microscopic Analytical Methods

Both dead and living microorganisms are quantified by this method (Douwes, 2005). However, identification of the fungal spores is often difficult: only a small number of fungal spore types can be identified with confidence at generic level, and significant genera such as Aspergillus and Penicillium cannot be differentiated. This method also has the disadvantages that the procedures are laborious and complicated, and the cost per sample is high.

SUMMARY PASSAGE 7

Cytometry Methods

In this study, propidium iodide was used as fluorescent intercalating agent to stain DNA. As this molecule is not specific for fungi, multiple parameters were used to differentiate fungal propagules from different cells and biotic debris in field samples. Solid-phase cytometry (SPC) may also be useful to quantify fungal spores in environmental samples (MÃ©heust et al., 2013;Vanhee et al., 2009a).

SUMMARY PASSAGE 8

Allergens

All these techniques have specific advantages and limits, so there is no "gold standard method" for assessing fungal contamination. Several authors suggest that combined sampling and analysis methods should probably be used to produce a more comprehensive picture of indoor fungal flora (Niemeier et al., 2006;PitkÃ¤ranta et al., 2008;Reboux et al., 2009). We nevertheless consider qPCR assays as robust tools that should be shared by many teams in the future to assess fungal exposure in indoor environments.

SUMMARY PASSAGE 9

Technical Challenges And Outlook

In certain environments, such as in high risk units of hospitals, the viability of a microorganism is a critical factor since it determines infectivity. Fungal spores can remain viable for a short period or for many years, depending on the fungal species, type of spore and storage conditions. However, no common analysis method can be considered perfectly accurate for detecting only live cells.

SUMMARY PASSAGE 10

Fungal Fragments: An Underestimated Reservoir Of Allergens?

These new technologies can be expected to have a tremendous effect on fungal biodiversity and ecology research. Only about 5% of the estimated 1.5 million species of extant fungi have been described, and sequence data are available for about 1% of the hypothesized number of fungal species (Begerow et al., 2010). At present, the large amount of sequence data obtained with highthroughput sequencing techniques contrasts with the lack of high-quality reference sequences with sufficient taxonomic information.