



# WEEKLY EPIDEMIOLOGICAL REPORT

A publication of the Epidemiology Unit  
Ministry of Health

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## Damp housing: Does it affect our health? (Part I)

This is the first in a series of two articles on the effect of dampness in indoor environment on inhabitants. The first article describes the agents which give rise to detrimental health effects and their mechanisms of action. The next article will focus on the health effects and recommendations for combating the dampness in indoor environment.

### Introduction

Several widely acknowledged global trends contribute to the conditions associated with increased exposure to dampness :

- Energy conservation measures that are not properly implemented (ventilation deficits, improper insulation)
- Urbanization (poorly constructed buildings and increased density of buildings, urban degradation, reduced availability of good quality housing, social inequity)
- Climate change (increasing frequency of extreme weather conditions, shifting of climate zones)
- The quality and globalization of building materials and components, construction concepts and techniques.

### Background

Excess moisture in the environment is known to encourage the growth of hundreds of species of bacteriae, fungi and insects. Dampness promotes the growth of dust mites and fungi in particular, both of which are known to play a major role in causing ill health under damp conditions.

Indoor environments contain a complex mixture of live and dead organisms, toxins, allergens, volatile microbial organic compounds and other chemicals, which are mostly produced by biological agents mentioned above. Inadvertent exposure of the occupants of buildings concerned to these organisms or products may give rise to respiratory symptoms, allergies, asthma and immunological reactions.

Dampness may also promote bacterial growth and the survival of viruses. In addition, dampness is an indicator of poor venti-

lation, which may result in increased levels of a wide range of other potentially harmful indoor pollutants. Excess moisture may also result in increased chemical emissions from building materials and floor covers. Standing water may attract cockroaches and rodents, which can transmit infectious diseases and are also a source of indoor allergens.

Some of the agents which are abundant in damp environments and are known to have adverse health effects are described below.

### Dust mites

House dust mites are arachnids, and many different species have been identified; however, only a few are of concern with respect to damp indoor environments. The natural food source of house-dust mites includes skin scales, although many other sources may be used. Therefore, in most houses, nutrition is abundantly available, particularly in mattresses and carpets or rugs. Studies have shown that most dust mites require a relative humidity in excess of 45–50% for survival and development, but they feed and multiply more rapidly at higher relative humidity. Damp houses therefore significantly increase exposure to dust-mite allergens.

### Fungi

Fungi are ubiquitous eukaryotic organisms, comprising of a large number of species. They may be transported into buildings on the surface of new materials or on clothing. They may also penetrate buildings through active or passive ventilation. Fungi are therefore found in the dust and surfaces of every house, including those with no problems with dampness. Once fungi are indoors, fungal growth can occur only in the presence of moisture, and many fungi grow readily on any surface that becomes wet or moistened; that is, virtually all fungi readily germinate and grow on substrates in equilibrium with a relative humidity below saturation.

As most indoor fungi grow at 10–35 °C, common indoor temperatures are not a limiting factor; temperature and nutrients are not critical and they may affect the rate of growth

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and the production of certain allergens and metabolites. Thus, water remains the most critical factor in indoor fungal growth.

#### **Bacteria**

Bacteria are ubiquitous prokaryotic single-cell organisms, and there is a large number of bacteria species which live in damp environments. They can be found in dust and on the surfaces houses, including those with no dampness problems. The main sources of bacteria in the indoor environment are outdoor air, people and indoor bacterial growth.

Bacteria from outdoor air and those originating from people are considered to be fairly harmless; bacteria growing actively or accumulating in the indoor environment, however, may affect health. Water is a critical requirement for bacterial growth. In fact, bacteriae require higher water activities than most fungi. The temperature and nutrient demands are generally met in most indoor environments

#### **Viruses**

It has been hypothesized that damp indoor environments with sufficiently high air humidity prolong the survival of respiratory viruses, so that the occupants are at greater risk of respiratory infection and, possibly, the onset of allergic disease. Although some experimental evidence shows significantly better survival times for several common cold-causing viruses, no real-life data are available

#### **Protozoa**

It is not clear whether protozoa in damp buildings contribute to ill health.

#### **The above mentioned biological agents cause ill health through following mechanisms**

##### **Allergens**

All agents that can induce a specific immune response (resulting in the production of specific antibodies) are potential allergens. The term allergen can refer to a single molecule, a mixture of molecules or a particle from which allergen molecules can be extracted. The latter can be dead material, like mite faecal particles, or viable particles such as bacteria or fungal spores. Thus, allergens comprise of a large variety of macromolecular structures, ranging from low-relative molecular mass sensitizers to high-relative molecular mass sensitizers. In damp indoor environments, those with a high-relative molecular mass are most relevant (e.g. house dust mite allergens and fungal allergens).

##### **House dust mite allergens**

Dust mites produce the predominant inhalation allergens in many parts of the world. The most common mite species that produce allergens are *Dermatophagoides pteronyssinus* and *Dermatophagoides farinae*. The major allergens produced by House dust mites are present in large amounts in faecal pellets. Elevated levels of these allergens have been detected in house dust, mattress dust and bedding in damp houses.

##### **Fungal allergens**

Many fungal species produce type I allergens, and immunoglobulin E (IgE) sensitization to the commonest outdoor and indoor fungal species like *Alternaria*, *Penicillium*, *Aspergillus* and *Cladosporium* spp. are strongly associated with allergic respiratory disease, especially asthma.

Fungi are also well-known sources of type III (or IgG-inducing) allergens. At high concentrations, fungi may also be involved in combined type III and IV allergic reactions, including hypersensitivity pneumonitis.

Many fungal allergens are glycopeptides with enzymatic properties. They are found in spores, hyphae and fungal fragments but are released in greater amounts during germination and mycelial growth. Germination and mycelial growth may occur inside the airways. The viability of spores is therefore important for allergenic expression, as confirmed by some studies on experimental animals. Non-viable fungal spores and hyphae release allergens at lower concentrations, but they are still likely to play an important role in fungi-related allergies and respiratory effects. The airborne concentrations of viable fungi in indoor environments are usually in the order of a few to several thousand colony-forming units (CFUs) per cubic metre of air. In a given space, concentrations of fungi are highly variable and depend on such factors as climate and season, type of fungus, construction, age and use of the building and ventilation rate etc.

##### **Endotoxins**

Endotoxins are integral components of the outer membrane of Gram-negative bacteria and are composed of proteins, lipids and lipopolysaccharides. They are often liberated as a result of cell lysis. In the environment, airborne endotoxins are usually associated with dust particles or aqueous aerosols. They have a broad size-distribution, but the coarse fraction may be higher. Heavy exposure to endotoxins can cause respiratory symptoms, including non-allergic asthma, but moderate to low exposure may protect against allergies and asthma. Lipopolysaccharides are a class of pure lipid carbohydrate molecules and are responsible for most of the immunological properties of bacterial endotoxins. The lipid moiety of lipopolysaccharides, called lipid A, is responsible for their toxic properties.

##### **Fungal (1→3)-β-D-glucans**

(1→3)-β-D-glucans are non-allergenic, water-insoluble structural cell wall components of most fungi, some bacteria, most higher plants and many lower plants. They consist of glucose polymers with variable relative molecular mass and degree of branching and may account for up to 60% of the dry weight of the cell wall of fungi.

##### **Mycotoxins**

Mycotoxins, or fungal toxins, are low relative molecular mass biomolecules produced by fungi, some of which are toxic to animals and human beings. Mycotoxins are known to interfere with RNA synthesis and may cause DNA damage. Some fungal species may produce various mycotoxins, depending on the substrate. In the case of *Penicillium*, one such compound is penicillin.

##### **Microbial and other volatile organic compounds**

Several fungi produce volatile metabolites, which are a mixture of compounds that can be common to many species, although some also produce compounds that are genera or species specific. Microbial volatile organic compounds are often similar to common industrial chemicals. To date, more than 200 of these compounds derived from different fungi including various alcohols, aldehydes, ketones, terpenes, esters, aromatic compounds, amines and sulfur-containing compounds have been identified.

##### **Source**

Dampness and moulds, available from

[www.euro.who.int/\\_data/assets/pdf\\_file/0017/43325/E92645.pdf](http://www.euro.who.int/_data/assets/pdf_file/0017/43325/E92645.pdf)

**Compiled by Dr. Madhava Gunasekera of the Epidemiology Unit**

**Table 1: Vaccine-preventable Diseases & AFP**

**29<sup>th</sup> October - 04<sup>th</sup> November 2011 (44<sup>th</sup> Week)**

Disease	No. of Cases by Province									Number of cases during current week in 2011	Number of cases during same week in 2010	Total number of cases to date in 2011	Total number of cases to date in 2010	Difference between the number of cases to date in 2011 & 2010
	W	C	S	N	E	NW	NC	U	Sab					
Acute Flaccid Paralysis	00	00	00	00	00	00	01	00	00	01	00	76	72	+ 05.5 %
Diphtheria	00	00	00	00	00	00	00	00	00	-	-	-	-	-
Measles	00	01	01	00	01	00	00	00	00	03	01	116	86	+ 34.9 %
Tetanus	00	00	00	00	00	00	00	00	00	00	00	24	21	+ 14.2 %
Whooping Cough	00	00	00	00	01	00	0	00	00	01	00	49	29	+ 40.2 %
Tuberculosis	42	04	92	10	04	00	01	16	32	201	195	7996	8662	- 07.7 %

**Table 2: Newly Introduced Notifiable Disease**

**29<sup>th</sup> October - 04<sup>th</sup> November 2011 (44<sup>th</sup> Week)**

Disease	No. of Cases by Province									Number of cases during current week in 2011	Number of cases during same week in 2010	Total number of cases to date in 2011	Total number of cases to date in 2010	Difference between the number of cases to date in 2011 & 2010
	W	C	S	N	E	NW	NC	U	Sab					
Chickenpox	06	06	12	02	02	03	07	02	08	48	48	3676	2935	+ 34.8 %
Meningitis	03 GM=1 CB=1 KL=1	04 KN=1 ML=3	00	01 JF=1	03 AM=1 TR=2	00	01 AP=1	03 BD=1 MO=2	04 KG=4	19	18	753	1395	- 46.0 %
Mumps	05	02	04	04	21	04	05	06	22	73	16	2792	1024	+ 172.6 %
Leishmaniasis	00	00	00	00	00	00	06 AP=1 PO=5	00	00	06	19	695	347	+100.3 %

**Key to Table 1 & 2**

**Provinces:** W: Western, C: Central, S: Southern, N: North, E: East, NC: North Central, NW: North Western, U: Uva, Sab: Sabaragamuwa.  
**DPDHS Divisions:** CB: Colombo, GM: Gampaha, KL: Kalutara, KD: Kandy, ML: Matale, NE: Nuwara Eliya, GL: Galle, HB: Hambantota, MT: Matara, JF: Jaffna, KN: Killinochchi, MN: Mannar, VA: Vavuniya, MU: Mullaitivu, BT: Batticaloa, AM: Ampara, TR: Trincomalee, KM: Kalmunai, KR: Kurunegala, PU: Puttalam, AP: Anuradhapura, PO: Polonnaruwa, BD: Badulla, MO: Moneragala, RP: Ratnapura, KG: Kegalle.

**Data Sources:**

**Weekly Return of Communicable Diseases:** Diphtheria, Measles, Tetanus, Whooping Cough, Chickenpox, Meningitis, Mumps.

**Special Surveillance:** Acute Flaccid Paralysis.

Leishmaniasis is notifiable only after the General Circular No: 02/102/2008 issued on 23 September 2008. .

**Dengue Prevention and Control Health Messages**

**Thoroughly clean the water collecting tanks bird baths, vases and other utensils once a week to prevent dengue mosquito breeding.**

**Table 4: Selected notifiable diseases reported by Medical Officers of Health**  
29<sup>th</sup> October - 04<sup>th</sup> November 2011 (44<sup>th</sup> Week)

DPDHS Division	Dengue Fever / DHF*		Dysentery		Encephalitis		Enteric Fever		Food Poisoning		Leptospirosis		Typhus Fever		Viral Hepatitis		Human Rabies		Returns Received
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	%
Colombo	25	8123	1	170	0	6	1	268	0	59	16	425	0	8	0	63	0	2	<b>46</b>
Gampaha	46	3367	0	118	1	18	0	86	0	81	4	465	0	24	14	332	0	6	<b>60</b>
Kalutara	21	1129	1	147	0	9	1	75	0	26	5	345	1	4	2	13	0	1	<b>67</b>
Kandy	60	1163	4	353	0	7	1	38	0	40	1	159	0	99	1	52	0	0	<b>91</b>
Matale	4	292	7	183	0	4	1	35	0	23	0	154	0	14	0	12	0	0	<b>75</b>
Nuwara	2	212	2	316	0	4	1	57	0	110	0	50	1	64	0	31	0	1	<b>77</b>
Galle	4	739	0	99	0	6	0	29	0	8	3	203	0	40	1	11	0	5	<b>68</b>
Hambantota	4	361	0	61	0	4	0	5	0	29	2	484	0	61	0	15	0	1	<b>75</b>
Matara	25	500	3	85	0	3	2	18	0	32	8	340	4	79	0	22	0	1	<b>94</b>
Jaffna	3	298	13	322	0	3	7	262	1	92	0	2	0	197	0	30	0	1	<b>73</b>
Kilinochchi	0	55	0	36	0	3	0	11	0	13	0	2	1	12	0	3	0	0	<b>50</b>
Mannar	2	45	0	23	0	1	1	32	0	83	0	13	0	33	0	2	0	0	<b>60</b>
Vavuniya	2	72	2	35	1	13	0	10	2	58	0	45	0	2	0	2	0	0	<b>100</b>
Mullaitivu	0	16	1	62	0	1	0	7	0	9	0	5	0	1	0	2	0	0	<b>25</b>
Batticaloa	3	849	0	558	0	5	0	7	0	27	0	27	0	3	0	2	1	7	<b>50</b>
Ampara	3	149	6	206	0	1	0	11	0	47	0	57	0	1	0	9	0	0	<b>43</b>
Trincomalee	2	147	11	639	0	2	0	10	0	12	0	92	0	7	1	8	0	1	<b>75</b>
Kurunegala	26	848	7	328	0	12	0	95	1	86	4	1505	1	77	4	62	0	4	<b>74</b>
Puttalam	6	433	0	173	0	1	0	31	0	25	1	119	0	18	0	7	0	2	<b>42</b>
Anuradhapu	0	253	1	126	0	2	0	5	0	34	1	240	0	17	1	25	0	1	<b>74</b>
Polonnaruw	2	268	2	118	0	1	0	14	0	22	2	84	0	1	1	17	0	0	<b>71</b>
Badulla	16	546	3	338	0	6	0	54	0	24	2	77	0	82	2	62	0	0	<b>59</b>
Monaragala	9	245	3	128	0	4	1	366	0	13	0	179	0	73	3	88	0	0	<b>91</b>
Ratnapura	11	893	3	461	0	7	0	51	0	26	6	539	1	29	8	64	0	2	<b>72</b>
Kegalle	38	875	2	108	0	12	2	75	0	24	4	326	0	33	10	242	0	0	<b>82</b>
Kalmune	1	35	2	547	0	0	1	3	0	85	0	6	0	2	0	3	0	1	<b>54</b>
<b>SRI LANKA</b>	<b>315</b>	<b>21913</b>	<b>74</b>	<b>5740</b>	<b>02</b>	<b>135</b>	<b>19</b>	<b>1325</b>	<b>04</b>	<b>1088</b>	<b>59</b>	<b>5943</b>	<b>09</b>	<b>981</b>	<b>48</b>	<b>1179</b>	<b>01</b>	<b>36</b>	<b>70</b>

Source: Weekly Returns of Communicable Diseases WRCD).

\*Dengue Fever / DHF refers to Dengue Fever / Dengue Haemorrhagic Fever.

\*\*Timely refers to returns received on or before 04<sup>th</sup> November, 2011 Total number of reporting units =329. Number of reporting units data provided for the current week: 228

A = Cases reported during the current week. B = Cumulative cases for the year.

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