Dampness and mould in schools and respiratory symptoms

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Indoor dampness is associated with respiratory symptoms in studies of homes and their occupants in many nations.[1] Specific office building populations have allowed study of incident diagnoses such as building-related asthma and hypersensitivity pneumonitis in relation to damp indoor environments, with incidence density of such diagnoses increased as much as sevenfold after occupancy of a damp office building compared with the prior period during adulthood.[2 3] Study of large numbers of persons in one building or school is more efficient than studies of occupants of many dwellings and allows increased precision in exposure classification for individuals. Within a single or small number of damp buildings, both measured microbial markers and observational grading of moisture indices are associated with a risk of building-related respiratory symptoms and diagnoses among occupants.[4–7] However, effective regulation in most countries requires demonstration of consistent relationships between environmental measurements and health risk across many buildings, and such evidence is lacking to date. The body of work underway in the HITEA study[8] is motivated in part to examine whether aggregated populations from many schools have a differential risk of respiratory health outcomes in relation to dampness indices and, if so, whether there are environmental measurements that are associated with risk. Ironically, the home environment will not be subject to effective regulation in most countries, despite the strongest body of evidence that dwelling dampness is associated with respiratory health risk.

The paper by Borràs-Santos *et al*[8] extends the study of school children from homes to damp and dry school environments. In all countries, children attending damp schools had higher odds of nocturnal dry cough. The inconsistent findings for other symptoms in the three countries are provocative. Finnish children had strong evidence of dampness-related increases in many respiratory indices in an exposure-dependent manner, but Spanish children in damp schools demonstrated increased symptoms (nasal symptoms apart from cold) only when analyses were limited to schools with somewhat modest response rates of 60% or higher, and Dutch children had no other dampness-related ill effects apart from nocturnal cough. Building-related nasal symptoms are a risk factor for developing building-associated asthma symptoms.[9] Since there is no reason for dampness-related adverse respiratory symptoms to differ by location of exposure in homes or schools, these country differences regarding school environments will lead to further hypotheses which may narrow the uncertainties about what investigators should measure in assessing indoor environmental risk. Certainly damp homes outside the Nordic climate have been shown to confer respiratory health risks, as have environmental measurements in single damp office buildings and schools across many latitudes.

One obvious source of the inconsistent findings across countries is misclassification of exposure. The investigators assumed that all children in a damp school had the same exposure. Certainly, within single damp office buildings and schools with building-related respiratory complaints, room- and workstation-specific dampness indices and measured exposures in vacuumed dusts have shown exposure-response relationships with risk of building-related symptoms.[4–7] Thus microenvironments exist within buildings, and ignoring them makes demonstration of relationships between environmental dampness and respiratory outcomes less likely. Perhaps mechanical ventilation present in Finnish schools (but absent in Spain and The Netherlands) homogenises exposures from structural dampness and lessens misclassification of exposure by school. Misclassification of health outcome is also a potential problem in between-country comparisons, especially with language and clinical care differences. In both Spain and Finland, a parent-reported asthma diagnosis was insensitive for report of wheezing and use of respiratory medication in comparison with school populations in The Netherlands.

School environments are a societal responsibility,[10] unlike the home environment or the workplace over which property owners preside. Although employers' workplaces are poorly regulated with regard to indoor environmental quality, adults have some ability to choose their workplaces, subject to socioeconomic barriers such as high unemployment rates. This is rarely true for choice of school environments by adults for their children, nearly all of whom attend school. The commitment to social justice for children from different walks of life in having equivalent educational environments[11] appears violated in the data presented in this multinational study: Finnish and Spanish students with parents having low educational levels were statistically more likely to attend damp schools and Spanish students of immigrant origin similarly were more likely to attend damp schools. In Finland, school absence for respiratory illness was associated with dampness indices in an exposure-dependent manner. Thus, ill health and absenteeism might align in affecting academic performance in an inequitable way across the socioeconomic spectrum.[11]

The search for building characteristics and materials associated with health risk and dampness requires continued investigation to elucidate remediable causes and improved health of all children. Such

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information will be valuable for healthy housing and healthy workplaces as well. In the meantime, intervention for dampness is warranted when building occupants have chest symptoms, despite the absence of quantitative environmental measures of risk.[12]

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