Respiratory infection in buildings: Transmission and roles of environment intervention

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Lower respiratory infections still remain the world leading cause of death. Respiratory diseases are spread between people in indoor environment via close contact, air, and contaminated surfaces, and indoor environment also affects pathogen spread by modifying the interaction of inhalation/exhalation between people, and air and surface hygienic conditions.

In this talk, based on two recent completed literature reviews (Wei and Li, 2017 and Zhang et al., in preparation), we shall synthesize existing knowledge on the release of respiratory droplets, their transport and dispersion in the indoor environment via close contact, airflows and surface touch, and the ultimate exposure of a susceptible host by both short-range (airborne, large droplet and immediate surfaces) and distant routes (airborne and fomites). Infectious agents are embedded in respiratory mucus, or expired mucus droplets, which evaporate, disperse, and deposit, and their size as they exit the mouth or nose in the indoor environment is an important parameter. We shall clarify the possible misleading information in the literature, including the threshold size of large droplets.

Our discussion on the mechanisms of close contact transmission reveals the mechanisms of intervention, i.e. avoidance or control of close contact, avoidance or control of expired jets, removal of inhaled/expired droplets, and environment (air, skin and inanimate surface) cleaning. Building ventilation is shown to be an effective intervention using the existing data. We shall discuss about the WHO recommendation on the use of natural ventilation. Economic constraints often lead to lack of adequate hospital facilities for the emerging infection challenges not only in resource-limited countries, and also in developed economies. Questions remain on the relative effectiveness, roles and costs of environment intervention, such as HVAC.

References
• Gao X, Wei J, Xu, P, Cowling BJ, Li Y. Building ventilation as an effective disease intervention strategy on a large and dense social contact network. PLOS One. 2016 Sep 9;11(9):e0162481