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Editorial: Ventilation and health: how much do we need and how do we achieve this?

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Editorial on the Research Topic
Ventilation and health: how much do we need and how do we achieve this?

People spend most of their time indoors, especially in homes. Therefore, the indoor environment plays an important role in occupants' comfort and health. Indoor environments contain pollutants from both outdoor and indoor sources. Ventilation is one of the most important means to remove or dilute indoor pollutants and maintain a habitable space for human beings.

In real life, indoor environments differ in pollution loads, making it difficult to set universal ventilation rates that meet health requirements.

Since the early 1970s, there has been an ongoing discussion about how to express ventilation standards. The question was, instead of giving ventilation rates, can we prescribe limiting values for pollutants? This would give designers greater freedom to find solutions. Such an air quality procedure has also been introduced in ASHRAE standard 62 (1982). This would work in a perfect world, where we would know the sources of pollutants, the source strength, and, especially, what pollutants are important from a public health perspective. Currently, we have a good understanding of a few pollutants and sources. However, we have limited knowledge regarding which ones are high-risk pollutants and the health implications of pollutants overall.

Besides a few new ideas, current ventilation technology essentially revolves around computational fluid dynamics (CFD). CFD is a fantastic tool, but its use in case studies is not really science. It is a use of a tool. As long as people moving, opening doors, and using lamps changes "everything", it cannot be used for predicting exposure and health effects. We need much faster computers and much more knowledge regarding indoor exposure and health effects to make CFD a reliable tool from a health point of view.

In this Research Topic, four papers on IAQ, ventilation, and health were selected, which hopefully provide a snapshot of the current research and development interests. Arar investigated the IAQ problem and pollution sources in residential buildings in Dubai. They found that building finishing materials became new indoor pollutants after people moved in. Through model prediction and experimental measurement, the cumulative emission amount of formaldehyde and VOCs from flooring material and wallpaper were identified, which could be served as basic data to explore the cause of indoor air pollutants in daily life to reduce sick building syndrome symptoms in Dubai. In a Canadian study on ventilation strategy and trichloramine removal in a swimming pool enclosure (Proulx and Halle), the authors numerically analyzed the concentration

of trichloramine (C_{NCL3}) with the variation of the outdoor air (OA) rate and the total air flow rate (TA) in five scenarios. They found that an OA increase by itself was not sufficient to reduce C_{NCL3} if no added air momentum was provided. The most significant C_{NCL3} reduction in the breathing zone was obtained by augmenting the TA to 8.0 ACH while leaving the OA unchanged. This ventilation strategy yielded an increase in the air velocity above the water surface from the ASHRAE-recommended 5.8 cm/s to 14.7 cm/s. The benefits of recirculated air on reducing indoor contaminants were confirmed by Walkinshaw and Horstman in their model predictions of airborne infection transmission risk for different settings. These two HVAC experts discovered that HVAC filtration on recirculated air would significantly decrease the incidence of respiratory illnesses. Huang et al. introduced portable/personal filtration (such as an air cleaner and mask wearing) units to work together with ventilation as airborne infection mitigation measures. Based on their model analysis, the authors stated that increasing outdoor air ventilation rates from 2 ac/h to 6 ac/h could have a considerable impact in reducing transmission risk in a well-mixed space. The infection risks for different ventilation rates can be calculated through their web-based calculator.

In summary, the findings of the studies in this Research Topic can serve to guide research for ventilation and health, HVAC system design, and pollutant mitigation measures. However further research is needed to study exposure, thermal comfort, and energy expenditure associations with a variation of ventilation parameters.

Author contributions

The author confirms being the sole contributor of this work and has approved it for publication.

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Conflict of interest

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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