Researchers call for national governments to mandate real-time indoor air quality monitoring

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In a response to the COVID-19 pandemic, a team of researchers has published an editorial calling for national governments to consider

mandating real-time indoor air quality monitoring in at least all public buildings.

Their editorial is published in the journal *Building Simulation*.

The three-year-long COVID-19 pandemic, caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has revealed that there is a global indoor-air crisis. Vaccination alone has not completely controlled the COVID-19 pandemic and the virus continues to threaten human health and life.

Scientists now know most if not nearly all transmission occurs indoors in poorly ventilated spaces. The researchers note in their editorial that since more than 6.5 million people have been reported to die globally due to the SARS-CoV-2 infection and people continue to be infected, there is an urgent need to improve ventilation in buildings worldwide.

The researchers observe that while two years have passed since it was officially recognized that airborne transmission of SARS-CoV-2 spreads the virus and some efforts have been made, there have been no significant improvements in building ventilation. Some governments have taken steps toward addressing the issue. The U.S. government issued its "Clean Air in Buildings Challenge" in March 2022, and the Hong Kong SAR government set a policy that requires six air changes per hour in 20,000 dine-in restaurants in the city.

"In the absence of a worldwide effort to improve building ventilation, it is likely that poorly ventilated buildings will remain common, meaning that airborne transmission of SARS-CoV-2 will continue. Moreover, if another novel and highly contagious respiratory virus emerges in the future, another pandemic is likely to occur," said Yuguo Li, a professor at The University of Hong Kong.

The researchers note that there are likely more than a billion indoor spaces in the world, and identifying those with poor ventilation remains a challenge. Understanding that SARS-CoV-2 is airborne is not enough—for effective improvement, technologies are needed to identify where ventilation is insufficient. They also note that any improvements in ventilation must also take into consideration the buildings' energy efficiency. This is necessary because energy efficiency is needed to mitigate the effects of climate change.

The two key components of building energy performance are thermal performance and ventilation performance. Humans can detect thermal conditions by using a thermometer to measure the temperature. But even though humans can detect odors, they cannot sense or predict a building's ventilation performance. So humans are not capable of detecting air pollutants, such as infection aerosols. This inability to detect most air pollutants contributes to the indoor air crisis, the researchers note.

The researchers suggest that without governments establishing mandatory requirements for building ventilation performance, building owners will unlikely choose to monitor their buildings' ventilation performance. The researchers also note that monthly or annual data on building ventilation rates is not sufficient.

Real-time hourly ventilation rates are needed to determine the ventilation performance of buildings. Taking into account the world's current population of seven billion people, the researchers suggest there are likely more than one billion homes globally. Along with that number, there are hundreds of millions of other indoor spaces, such as office buildings and movie theaters. It is an unrealistic goal at present to attempt to conduct real-time hourly monitoring for all those indoor spaces.

Bringing the changes needed to improve building ventilation is highly challenging. If adequate ventilation data existed then a predictive tool could be used, at low cost, for many buildings. The Internet of Things technologies enable the collection of good quality real-time date in indoor spaces. Integrating predictive tools with Internet of Things, big data, and machine learning approaches would give scientists a way to assess the ventilation performance of buildings.

"We remain optimistic that future innovation will result in advances in economic monitoring and predictive tools for determining ventilation performance in the billions of indoor spaces worldwide," said Li.

More information: Yuguo Li et al, Predicting building ventilation performance in the era of an indoor air crisis, *Building Simulation* (2023). DOI: 10.1007/s12273-023-1019-z

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