# Revolutionising indoor air quality to stop pandemics with Germicidal Ultraviolet (GUV) technology

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## Indoor air quality is a silent public health crisis, harbouring pathogens that contribute to billions of illnesses annually. Addressing this requires urgent attention, and Germicidal Ultraviolet (GUV) technology offers a powerful solution to combat airborne threats

This exclusive interview with Assistant Professor of Public Health and leader of The Human Health and Harmony Lab (H3) Jacob Bueno de Mesquita explores the hidden dangers of shared air, the transformative potential of Germicidal Ultraviolet (GUV) technology, and the vision for a future where indoor spaces contribute to healthier, more resilient communities.

## Why indoor air matters

### 1. Could you start by explaining why indoor air quality is such a critical public health issue and why it deserves more attention?

The air that we breathe in indoor spaces contains exhaled viruses and bacteria from indoor occupants. The simple act of entering an indoor space shared with others leads to a sizeable burden of disease at the population scale that could be substantially reduced with indoor air cleaning.

Airborne respiratory viruses like SARS-CoV-2 and other coronaviruses, influenza virus, respiratory syncytial virus (RSV), and rhinovirus cause billions of instances of illness each year and lead to severe infection or death for up to tens of millions. Measles – a highly infectious airborne virus – is resurging in the United States and elsewhere due to decreasing vaccine coverage. Tuberculosis, which spreads exclusively through the airborne mode, continues to kill over 1 million people annually.

In addition to this baseline level of disease burden due to the inhalation of airborne pathogens, pandemic viruses that often spread through inhalable airborne particles, such as SARS-CoV-2 and various pandemic influenza viruses, threaten the lives and health of the entire global population. We expect new viruses with pandemic potential to emerge and threaten populations like COVID-19 did or even more severely.

For example, the current H5N1 panzootic triggering the culling of over 166 million birds and nearly 1,000 dairy herds in the US alone as of late February 2025 could easily result in a farmed animal or human, kicking off a new pandemic. Animal agriculture provides fertile grounds for new pandemic viruses to evolve and spillover into humans, and thus,

minimizing animal agriculture would be the surest actionable step to reduce pandemic emergence. Indoor air cleaning is essential to deal with and prevent common infections each year while also assuring better resilience to the next plague.

## From CDC to GUV

**2. Your work focuses on improving environmental health and harmony. What initially sparked your interest in indoor air quality, and what motivates you to research and advocate for technologies like GUV?**

After college, I joined the CDC field service and worked on a Tuberculosis contact investigation in central Ohio. While being sent to identify new potential TB cases among workers in an egg production facility to search for active (infectious) TB cases, I was not provided with any respiratory protection or recommendations. When I inquired about this with my CDC superiors, nobody could give me a clear set of guidelines for respiratory protection or reasoning about what level of risk there would be. This sparked my initial interest in studying airborne pathogen spread.

I appreciate the environmental health field's perspective on creating healthy, safe, and more just living and working conditions that ease the burden on individuals for sometimes demanding personal action to protect themselves. I'm working to study and enhance the implementation of such health-promoting environmental conditions in my Human Health and Harmony Lab (H3) through projects demonstrating air cleaning, decarbonized and healthy indoor environments, and the adoption of healthier and more environmentally harmonious foodscapes.

## Beyond respiratory infections: The hidden dangers of shared air

**3. Your previous work highlights the "hidden danger of shared air." Can you elaborate on the broader public health implications of poor indoor air quality beyond just respiratory infections? Are there links to other health issues?**

This line may refer to the reality that people contaminate indoor air with infectious airborne viruses simply by exhaling, even when they show no symptoms of a respiratory infection.

Joshua Weitz, a biologist at the University of Maryland, recently published a book on this subject called Asymptomatic, and it's something I wrestled with in my dissertation. Moreover, a growing body of evidence highlights the various body systems that could be affected by respiratory viral infections, including the brain and cardiovascular system, along with long-term effects and increased risks of subsequent non-communicable diseases.

## GUV: Inactivating pathogens, not just filtering air

**4. Germicidal Ultraviolet (GUV) technology holds significant promise for improving indoor air quality. Can you provide a brief overview of how GUV disinfects the air**

**and why it's being considered a crucial tool in combating airborne pathogens?**

GUV does not filter air; instead, it inactivates viruses by disrupting their genomic material, rendering them non-infectious. This technology provides the most efficient form of air cleaning for airborne viruses and bacteria, producing dozens, if not hundreds, of equivalent air changes per hour. To illustrate this in terms of ventilation, it would take something like adding massive air blowers in a room, which simply isn't feasible in most environments. Even if copious air flow were feasible, it would introduce high energy demands and generate significant noise, thus limiting its real potential.

Such efficient air cleaning is necessary because humans can shed hundreds of infectious doses into their exhaled breath per hour. To mitigate widespread transmission or super-spreading, we need approximately one equivalent air change per hour for each infectious dose shed per hour. GUV is the only technology that provides anywhere near enough air cleaning to stop super-spreading events.

## Portable GUV: Expanding protection beyond fixed installations

**5. You mentioned the development of portable GUV devices in your other work. What are the potential applications and challenges of such devices, and when might we see them become widely available?**

Permanent GUV fixtures of the upper-room 254 nm or whole-room 222 nm (far-UVC) variety offer continuous air cleaning. Portable GUV devices like some far-UVC mounted on tripods could offer solutions for spaces not already outfitted with permanent fixtures or in residences that want to protect certain spaces at different times (e.g., a dinner table during a meal and then the living room afterwards during socializing). Part of the adoption problem with such devices is that people are mostly ignorant about the level of risk posed by breathing indoor air, let alone aware of GUV technology and how powerful it is. Furthermore, due to the widespread underadoption of the technology, there are some initial costs to getting set up (well worth it), and institutions and the general population may not know where to look to purchase and get any help correctly installing GUV.

## Where GUV can make a difference

**6. Beyond prisons, what other high-risk environments could particularly benefit from GUV technology (e.g., hospitals, schools, public transportation)? Can you provide specific examples?**

Healthcare settings should absolutely adopt GUV to safeguard healthcare workers and patients while minimizing the risk of ongoing outbreaks. This is perhaps the clearest of settings, as individuals frequently seek healthcare when they have infections or some immunocompromising condition that could render them more susceptible to infection or more contagious.

Long-term care facilities would also serve as excellent places for protection. There is particular importance in safeguarding all populations with reduced immunity, not only for the benefit of those vulnerable to infection but also because infections in immunocompromised groups could lead to viral evolution, potentially driving further community spread. Settings that gather large groups of people, such as university and K-12 environments, present significant opportunities for reducing transmission risk through GUV. While these settings could also focus on health centres on campuses, nurses' offices, and areas where individuals with immunocompromising conditions work, the greatest benefit arises from implementing GUV across entire campuses, providing population protection overall. Otherwise, individuals might find protection in only half of the spaces they occupy daily (e.g., classrooms) but could still spread viruses to one another in other areas (e.g., student centres, dining halls, etc.). I would love to see GUV in cafés, restaurants, gyms, dance clubs, karaoke bars, yoga studios, buses, trains, office buildings, and places of worship.

## GUV as a cornerstone of resilient communities

### 7. What is your vision for the future of indoor air quality management, and what role do you see GUV technology playing in creating healthier and more resilient communities?

GUV represents a crucial aspect of indoor air quality that addresses pathogen transmission. While airborne transmission poses significant risks at all times (e.g., flu and other respiratory viruses circulate annually), its importance increases during pandemics, which can arise rapidly and sometimes without warning. When a pandemic occurs, we may not have a vaccine ready, and even if one is available, it is unlikely that everyone on the planet will be immunized before encountering the pandemic pathogen. This also brings about issues related to the inequitable distribution of vaccines. Therefore, widespread adoption of GUV to ensure the safety of our indoor environments during a pre-pandemic phase helps us avoid the problems we would inevitably face during a pandemic.

While GUV may be the most important underused aspect of the built environment today, it is not the only useful element for building design and management. Buildings still require good airflow and filtration, thermal and lighting comfort, and other elements that optimize the sensory experience of indoor spaces through biophilic and other design features. We should consider how buildings can be places of delight, rather than boring, static, stuffy, unhealthy, and sometimes dangerous environments. We know we can create healthy and inviting spaces often while reducing energy demand and improving the cognitive and creative performance of indoor occupants. Yet, despite the substantial knowledge about the importance of GUV and healthy indoor environments, we still face a major problem of low adoption. A significant effort is needed to increase the adoption of GUV and healthy building design, as it will yield major benefits in terms of population wellness and associated economic returns.