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A Blueprint for Far-UVC Use in Sustainable Air Disinfection

Objective: Protecting indoor air from infectious aerosols is both a significant challenge and a remarkable opportunity for improving public health. Recent standards, such as ASHRAE 241, set equivalent clean air delivery rate targets to reduce airborne transmission risk. While increased ventilation and added filtration can meet these targets in some settings, many environments—such as classrooms, gyms, and restaurants—require impractically high ventilation rates to achieve sufficient infection risk mitigation. This creates substantial energy and infrastructure costs that may be unsustainable long-term. This gap highlights the need for additional strategies to supplement traditional air quality interventions. Far-UVC –an emerging type of germicidal UV light –could provide a more sustainable and practical approach when integrated with existing technologies.

Methods and Results: To develop an actionable roadmap for far-UVC disinfection, we conducted extensive literature reviews, semi-structured interviews with over 100 experts from academia, industry, government, healthcare, and the non-profit sector, and performed parametric modeling using the Wells-Riley infection risk framework. This multidisciplinary effort evaluated far-UVC's potential to inactivate pathogens in diverse settings, focusing on technical domains such as disinfection efficacy, photobiological safety, materials compatibility, and indoor air chemistry.

Our analysis found that far-UVC can be both safe and effective when properly implemented. Current evidence supports its safety below existing exposure guidelines, with studies showing minimal DNA damage in skin and eyes due to limited tissue penetration. When integrated with other air cleaning technologies, far-UVC offers several advantages: it can reduce the ventilation rates needed to achieve equivalent clean air delivery targets, operates with lower energy consumption than equivalent ventilation, and may be more practical to implement in spaces where traditional interventions face limitations.

Conclusions: The COVID-19 pandemic has created unprecedented momentum for improving indoor air quality, but sustaining these improvements requires solutions that are both effective and practical to maintain long-term. Our comprehensive assessment suggests that far-UVC, as part of an integrated approach with traditional interventions, could help address this challenge. However, realizing this potential requires coordinated action across multiple stakeholders to address remaining technical and implementation barriers. This work provides a roadmap for that coordinated action, with the goal of supporting sustainable improvements in indoor air quality that can protect against both routine and epidemic respiratory diseases.

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