Public Restroom Review

The COVID crisis is a remarkable threat to public health with incidence rates rising to shocking levels[1]. Economic impact estimates from this recent SARS epidemic are staggering[2]. This unprecedented situation, resulting from the extreme virulence of SARS-CoV-2 requires novel approaches and evidence-based solutions[3].

SARS-CoV-2 has been isolated in urine and feces[4], demonstrated that the well-publicized respiratory droplet vector concept may lack not only a description of fecal oral transmission but also void of an informed perspective on risks of aerosolized excrement[5].

Transmission dynamics around the human envelope for a virus, particularly SARS-CoV-2 are complex[6]. The restroom environment is particularly concerning, as modern flush toilets produce prodigious excrement aerosols. Previous work demonstrates that ***10^4 to 10^9 bacterial microorganisms may be present per gram of human stool[7] and up to 10^9 viral particles in similar sample sizes[8]. Human vomit also may harbor viral pathogens, also in extremely high concentrations (10^6)[9].***

Fluid dynamics analysis has demonstrated alarming results. Toilets produce aerosols during the flushing process with **40-60% measured particles rising above the toilet bowel (>100 cm) DURING the flushing cycle with continued airborne diffusion in the post flushing period (due to measures velocities of > 5 m/s)[10].**

There is a growing body of literature on air and surface disinfection with peer reviewed data demonstrating the utilization of continuous UVC as an option for enhanced disinfection to reduce the risk of infection [11][12].

[1] https://www.cdc.gov/coronavirus/2019-ncov/covid-data/covidview/index.html
[2] http://www.nber.org/papers/w26867
[3] A. Cohen and J. Cromwell. POPULATION HEALTH MANAGEMENT. Volume 00, Number 00, 2020
[4] Xiao, F., Sun, J., Xu, Y., Li, F., Huang, X., Li, H....Zhao, J. (2020). Infectious SARS-CoV-2 in Feces of Patient with Severe COVID-19. Emerging Infectious Diseases, 26(8), 1920-1922. https://dx.doi.org/10.3201/eid2608.200681.
[5] J. Sun et al. (2020) Isolation of infectious SARS-CoV-2 from urine of a COVID-19 patient, Emerging Microbes & Infections, 9:1, 991-993, DOI: 10.1080/22221751.2020.1760144
[6] Analysis of the Transmission Dynamics of COVID-19: An Open Evidence Review. Jefferson T, Spencer EA, Plüddemann A, Roberts N, Heneghan C. https://www.cebm.net/evidence-synthesis/transmission-dynamics-of-covid-19/.
[7] Aerosol Sci Technol. 2013; 47(9): 1047–1057. doi: 10.1080/02786826.2013.814911
[8] Atmar RL, Opekun AR, Gilger MA, Estes MK, Crawford SE, Neill FH, Graham DY. Norwalk Virus Shedding After Experimental Human Infection. Emerg. Infect. Dis. 2008;14:1553–1557.
[9] Caul EO. Small Round Structured Viruses: Airborne Transmission and Hospital Control. Lancet. 1994;343:1240–1242.
[10] Phys. Fluids 32, 065107 (2020); https://doi.org/10.1063/5.0013318.
[11] Anderson et al. Lancet 2017; 389: 805–14.
[12] Yang et al. Journal of Microbiology, Immunology and Infection (2019) 52, 487e493.

Air Hygiene Saves Lives™ through the use of continuous UVC to reduce the risk of respiratory tract infection[13]. SARS **viridae including SARS-CoV-2 are extremely suspectable to continuous UVC, even at a high viral load[14][15].**

We propose the utilization of continuous UV-C in high traffic private, and all public restrooms through both surface decontamination and air hygiene (utilizing a Calculated Convention™ paradigm) reducing the risk of SARS-CoV-2 infection within the restroom envelope with planned, evidence-based implementation[16][17][18][19].

Carl R. Peterson MD MS DABR
Chief Science Officer
11/20/20

[13] Menzies et al. Volume 362, ISSUE 9398, P1785-1791, November 29, 2003.
[14] Darnell et al. Journal of Virological Methods 121 (2004) 85–91.
[15] Heilingloh et al. Susceptibility of SARS-CoV-2 to UV Irradiation, AJIC: American Journal of Infection Control (2020), doi: https://doi.org/10.1016/j.ajic.2020.07.031.
[16] https://www.cdc.gov/coronavirus/2019-ncov/community/reopen-guidance.html
[17] https://www.cmmonline.com/articles/restroom-care-in-the-age-of-covid-19
[18] Zakaria et al. Int J Environ Health Res. 2016 Oct-Dec;26(5-6):536-53. doi: 10.1080/09603123.2016.1217313. Epub 2016 Aug 10. PMID: 27666295.
[19] Cooper et al. American Journal of Infection Control 44 (2016) 1692-4.