



Academic Digest

| APRIL 2021

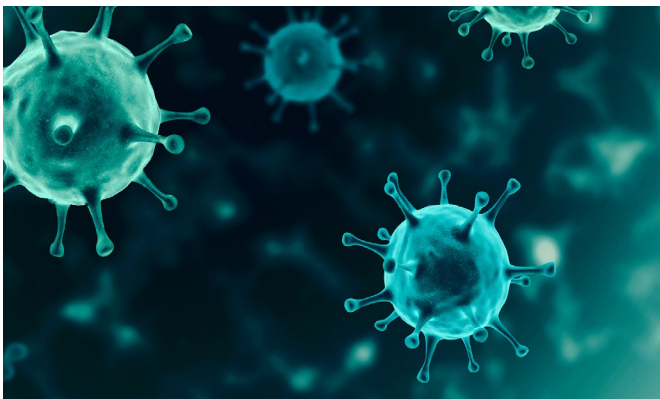




Welcome to the 4th edition of the Inivos Academic Digest for 2021, where our team share the most interesting and thought-provoking research across microbiology, personal protective equipment (PPE) and infection prevention and control.

Over April, more research has been noted on the emergence of co-infections in COVID-19 patients and how multi-drug resistant pathogens can possess further health complications and increase mortality rates. Papers were published in the Journal of Hospital Infection, Environmental Science and Pollution Research International, and Journal of Clinical Medicine. In addition, some published work further emphasised the viability of SARS-CoV-2 in different vectors of transmission including air and water.

The next challenge will be to further examine efficacy of decontamination technologies including gamma radiation, ozone and UV light in decontaminating FFR and N95 masks. Papers were published in PloS One and the Journal of Hospital Infection.



One paper in the Journal of Hospital Infection² investigated the impact of coinfections on the mortality rates of 212 severely ill COVID-19 patients. The authors found that fungal and/or bacterial isolation occurred in 89 patients, of which 83.14% passed away. Coinfections increased the risk of death if patients suffer from cardiovascular disease, diabetes or obesity. In addition, the increased risk of death was detected for negative-coagulase Staphylococcus, Candida non-albicans, S. aureus, Acinetobacter spp., Pseudomonas spp. and C. albicans. It was concluded that severe COVID-19 patients with secondary coinfections required longer hospitalisation and had higher risk of death.

SARS-COV-2 AND RISK OF COINFECTIONS

One study in the journal of Environmental Science and Pollution Research International¹ monitored the presence of SARS-CoV-2, bacteria and fungi in the indoor air of different hospital wards. A total of 107 indoor air samples (45 SARS-CoV-2, 62 bacteria and fungi) were collected from different wards for analysis. The researchers found that the most predominant bacteria were a genus of Staphylococcus, Bacillus, and Pseudomonas. Also, the most prevalent fungi genera in all the surveyed wards were Cladosporium spp. followed by Alternaria spp., Penicillium spp., and Yeast spp. In addition, significant correlation ($p < 0.05$) was found between airborne bacterial concentration and the presence of SARS-CoV-2, while no significant correlation was found between fungi concentration and the virus presence.

Correspondingly, a retrospective observational study in the Journal of Clinical Medicine³ characterised 293 COVID-19 patients at a large central Italy hospital, who developed bloodstream infections due to secondary infections. Authors found that 46 patients (15.7%) had a hospital-acquired clinically relevant BSI secondary to SARS-CoV-2 infection of which, 26 (56.5%) survived and 20 (43.5%) died. In addition, sixty-nine species were isolated, including Staphylococcus aureus (32.8%), Enterobacterales (20.7%), Enterococcus faecalis (17.2%), Candida (13.8%) and Pseudomonas aeruginosa (10.3%). The researchers suggested that mortality is high among hospitalised patients with COVID-19 who develop BSI secondary to SARS-CoV-2, as well as is the rate of BSIs due to antimicrobial-resistant organisms.

SARS-COV-2 PERSISTENCE AND VIABILITY

A paper in the International Journal of Infectious Disease⁴ assessed the viability of SARS-CoV-2 in the air of a car driven by a COVID positive patient. The researchers used a Sioutas personal cascade impactor sampler (PCIS) to detect SARS-CoV-2 and they found that the virus was detectable by PCR and was cultured from the sampler collecting particles in the 0.25 to 0.50µm size range, highlighting the potential risk of SARS-CoV-2 transmission from asymptomatic person in a closed space.

A systemic review and meta-analysis in Clinical and Translational Gastroenterology⁵ analysed the prevalence of the shedding of faecal RNA in COVID-19 patients. Thirty-five studies were included in the review of which thirty studies reported the prevalence of faecal viral RNA in patients with COVID-19 infection. The authors found that faecal SARS-CoV-2 RNA is commonly detected in COVID-19 patients with a 3-fold increased risk with diarrhoea and shedding of faecal RNA lasted more than 3 weeks after admission.

A study in The Science of the Total Environment⁶ investigated the presence of SARS-CoV-2 RNA in different freshwater and wastewater environments in Mexico. Using PCR testing, 44% of the groundwater samples had detectable viral loads between 2.6 and 38.3 copies/ml, 12% of the surface water dam samples tested positive for viral RNA, with values varying between 3.3 and 3.8 copies/ml, and 13% of the river samples were positive for viral RNA, with concentrations ranging from 2.5 to 7.0 copies/ml. In addition, untreated wastewater samples taken in the same period showed viral loads of up to 3535 copies/ml. These findings further confirm the viability of SARS-CoV-2 in different aqueous environments but more research is needed to determine transmission through water.

PPE DECONTAMINATION

One study in PLoS One⁷ evaluated the effects of gamma radiation on the performance of two models of N95 respirators. The researchers found that both respirator models exhibited statistically significant decreases in particle filtering efficiencies and electrostatic potential after irradiation. It was revealed that gamma radiation can modify the electrostatic charge on the filter and this change coincided with a decrease in aerosol filtering efficiency (40-50%) around the 75–300 nm particle size.



A review in the Current Treatment Options in Infectious Diseases⁸ analysed the efficacy of ultraviolet germicidal irradiation in decontaminating filtering facepiece respirators (FFR). The authors found that UVGI has been reported numerously to be effective in decontaminating FFRs while

maintaining mask integrity. However, UVGI was associated with degradation of strap integrity at higher doses than that utilised for decontamination or with reuse beyond 20 times.

One paper in the Journal of Hospital Infection⁹ examined the efficacy of an automated room disinfection system based on ozone against bacteriophage and bovine coronavirus L9 as surrogate viruses for SARS-CoV-2. The ozone-based room disinfection system achieved virucidal efficacy of more than log₄ reduction (99.99%) against both surrogate organisms regardless of the different surfaces and positions confirming a high activity under the used conditions. However, further research is necessary for a safe application and efficacy in practice as well as integration into routine processes.

REFERENCES

1. Hemati, S., Mobini, G. R., Heidari, M., Rahmani, F., Soleymani Babadi, A., Farhadkhani, M., Nourmoradi, H., Raeisi, A., Ahmadi, A., Khodabakhshi, A., Sadeghi, M., Bagheri, M., Validi, M., Taghipour, S., & Mohammadi-Moghadam, F. (2021). Simultaneous monitoring of SARS-CoV-2, bacteria, and fungi in indoor air of hospital: a study on Hajar Hospital in Shahrekord, Iran. *Environmental science and pollution research international*, 1–11. Advance online publication. <https://doi.org/10.1007/s11356-021-13628-9>
2. Silva, D. L., Lima, C. M., Magalhães, V., Baltazar, L. M., Peres, N., Caligiore, R. B., Moura, A. S., Fereguetti, T., Martins, J. C., Rabelo, L. F., Abrahão, J. S., Lyon, A. C., Johann, S., & Santos, D. A. (2021). Fungal and bacterial coinfections increase mortality of severely ill COVID-19 patients. *The Journal of hospital infection*, S0195-6701(21)00151-1. Advance online publication. <https://doi.org/10.1016/j.jhin.2021.04.001>
3. Posteraro, B., De Angelis, G., Menchinelli, G., D'Inzeo, T., Fiori, B., De Maio, F., Cortazzo, V., Sanguinetti, M., & Spanu, T. (2021). Risk Factors for Mortality in Adult COVID-19 Patients Who Develop Bloodstream Infections Mostly Caused by Antimicrobial-Resistant Organisms: Analysis at a Large Teaching Hospital in Italy. *Journal of clinical medicine*, 10(8), 1752. <https://doi.org/10.3390/jcm10081752>
4. Lednický, J. A., Lauzardo, M., Alam, M. M., Elbadry, M. A., Stephenson, C. J., Gibson, J. C., & Morris, J. G., Jr (2021). Isolation of SARS-CoV-2 from the air in a car driven by a COVID patient with mild illness. *International journal of infectious diseases : IJID : official publication of the International Society for Infectious Diseases*, S1201-9712(21)00375-1. Advance online publication. <https://doi.org/10.1016/j.ijid.2021.04.063>
5. Zhang, Y., Cen, M., Hu, M., Du, L., Hu, W., Kim, J. J., & Dai, N. (2021). Prevalence and Persistent Shedding of Fecal SARS-CoV-2 RNA in Patients With COVID-19 Infection: A Systematic Review and Meta-analysis. *Clinical and translational gastroenterology*, 12(4), e00343. <https://doi.org/10.14309/ctg.0000000000000343>
6. Mahlknecht, J., Padilla Reyes, D. A., Ramos, E., Reyes, L. M., & Álvarez, M. M. (2021). The presence of SARS-CoV-2 RNA in different freshwater environments in urban settings determined by RT-qPCR: Implications for water safety. *The Science of the total environment*, 784, 147183. Advance online publication. <https://doi.org/10.1016/j.scitotenv.2021.147183>
7. DeAngelis, H. E., Grillet, A. M., Nemer, M. B., Wasiolek, M. A., Hanson, D. J., Omana, M. A., Sanchez, A. L., Vehar, D. W., & Thelen, P. M. (2021). Gamma radiation sterilization of N95 respirators leads to decreased respirator performance. *PLoS one*, 16(4), e0248859. <https://doi.org/10.1371/journal.pone.0248859>
8. Ridder, M. P., Paladino, K. D., Lowe, J. J., & Rupp, M. E. (2021). A Practical Approach to Filtering Facepiece Respirator Decontamination and Reuse: Ultraviolet Germicidal Irradiation. *Current treatment options in infectious diseases*, 1–12. Advance online publication. <https://doi.org/10.1007/s40506-021-00247-8>
9. Franke, G., Knobling, B., Brill, F. H., Becker, B., Klupp, E. M., Campos, C. B., Pfeiffer, S., Lütgehetmann, M., & Knobloch, J. K. (2021). An automated room disinfection system using ozone is highly active against surrogates for SARS-CoV-2. *The Journal of hospital infection*, S0195-6701(21)00158-4. Advance online publication. <https://doi.org/10.1016/j.jhin.2021.04.007>