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Microbiological safety of filtering facepiece respirator sterilisation using vapour hydrogen peroxide

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Background: The COVID-19 pandemic highlighted the risk of filtering face-piece respirator (FFR) shortage at hospital level leading to a potential for significant rates of infection amongst frontline healthcare workers. To circumvent such shortage, extending the lifespan of FFR by means of decontamination and re-use was suggested. The aim of this study is to validate the use of vapour hydrogen peroxide (VHP) in the decontamination of facial personal protective equipment (PPE) through mechanical and biological analysis.

Methods: VHP capability to inactivate pathogens was assessed using experimentally inoculated masks. FFRs were contaminated with clinical strains of bacteria (gram negative: *Escherichia coli* & gram positive: *Staphylococcus aureus*), fungus (*Candida albicans*) and virus (SARS-CoV-2). Infection post-sterilization was determined via colony forming units. SARS-CoV-2 detection with q-PCR using primers and probes recommended by Centre for Disease Control and Prevention and World Health Organisation.

Results: The infected control mask contained 1.7×10^5 colony forming units colony forming units CFU's/20 μ L of *Staphylococcus aureus* and 1×10^5 CFU's/20 μ L of *E. coli*. Following VHP sterilization there was no detectable bacteria on the masks ($P=0.0006$, $n=3$). Similarly, fungus was

detectable in control masks 1×10^6 CFU's/20 μ L, however following VHP sterilization it was not detectable ($P<0.0008$, $n=3$). SARS-CoV-2 was detectable in control masks (ct value 23–26 cycles), following VHP sterilization there was no detectable virus (ct >33 cycles) ($P<0.0001$, $n=11$).

Conclusions: VHP is an efficient decontamination method of used FFRs eradicating bacteria, fungus and virus (SARS-CoV-2) even after five cycles of usage. These data suggest that should there be a shortage of PPE in hospitals in the future, masks can be sterilized and re-used to protect the health of front line workers.

Keywords: COVID-19; decontamination; filtering face piece respirator (FFR); microbiological safety; SARS-Cov-2; vapour hydrogen peroxide

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Footnote

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