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# Viable virus aerosol propagation by positive airway pressure circuit leak and mitigation with a ventilated patient hood

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**This live virus model demonstrates that PAP mask leak maybe a major source of environmental contamination and nosocomial spread of infectious respiratory diseases. A simply constructed ventilated hood with a HEPA filter is an efficacious countermeasure.** <https://bit.ly/2HUijgn>

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## ABSTRACT

**Introduction:** Nosocomial transmission of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has been a major feature of the COVID-19 pandemic. Evidence suggests patients can auto-emit aerosols containing viable viruses; these aerosols could be further propagated when patients undergo certain treatments, including continuous positive airway pressure (PAP) therapy. Our aim was to assess 1) the degree of viable virus propagated from PAP circuit mask leak and 2) the efficacy of a ventilated plastic canopy to mitigate virus propagation.

**Methods:** Bacteriophage phiX174 ( $10^8$  copies·mL<sup>-1</sup>) was nebulised into a custom PAP circuit. Mask leak was systematically varied at the mask interface. Plates containing *Escherichia coli* host quantified viable virus (*via* plaque forming unit) settling on surfaces around the room. The efficacy of a low-cost ventilated headboard created from a tarpaulin hood and a high-efficiency particulate air (HEPA) filter was tested.

**Results:** Mask leak was associated with virus contamination in a dose-dependent manner ( $\chi^2=58.24$ ,  $df=4$ ,  $p<0.001$ ). Moderate mask leak ( $\geq 21$  L·min<sup>-1</sup>) was associated with virus counts equivalent to using PAP with a vented mask. The highest frequency of viruses was detected on surfaces <1 m away; however, viable viruses were recorded up to 3.86 m from the source. A plastic hood with HEPA filtration significantly reduced viable viruses on all plates. HEPA exchange rates  $\geq 170$  m<sup>3</sup>·h<sup>-1</sup> eradicated all evidence of virus contamination.

**Conclusions:** Mask leak from PAP may be a major source of environmental contamination and nosocomial spread of infectious respiratory diseases. Subclinical mask leak levels should be treated as an infectious risk. Low-cost patient hoods with HEPA filtration are an effective countermeasure.