

Article

Ventilation-Associated Particulate Matter is a Potential Reservoir of Multidrug-Resistant Organisms in Health Facilities

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Abstract: Most healthcare-associated infections (HCAIs) develop due to the colonisation of patients and healthcare workers by multidrug-resistant organisms (MDRO). Here, we investigated whether the particulate matter from the ventilation systems (Vent-PM) of health facilities can harbour MDRO and other microbes, thereby acting as a potential reservoir of HCAIs. Dust samples collected in the ventilation grilles and adjacent air ducts underwent a detailed analysis of physico-chemical properties and biodiversity. All Vent-PM samples included ultrafine PM capable of reaching the alveoli. Strikingly, > 70% of Vent-PM samples were contaminated, mostly by viruses (> 15%) or multidrug-resistant and biofilm-producing bacterial strains (60% and 48% of all bacteria-contaminated specimens, respectively). Total viable count at 1 m from the ventilation grilles was significantly increased after opening doors and windows, indicating an association between air flow and bacterial contamination. Both chemical and microbial compositions of Vent-PM considerably differed across surgical vs. non-surgical and intensive vs. elective care units and between health facilities located in coal and chemical districts. Reduced diversity among MDRO and increased prevalence ratio in multidrug-resistant to the total *Enterococcus spp.* in Vent-PM testified to the evolving antibiotic resistance. In conclusion, we suggest Vent-PM as a previously underestimated reservoir of HCAI-causing pathogens in the hospital environment.

Keywords: particulate matter; air pollution; hospital dust; ventilation grilles; multidrug-resistant organisms; healthcare-associated infections; HCAI-causing pathogens; reservoir of infection; microbial diversity; chemical composition

Supplementary Materials:

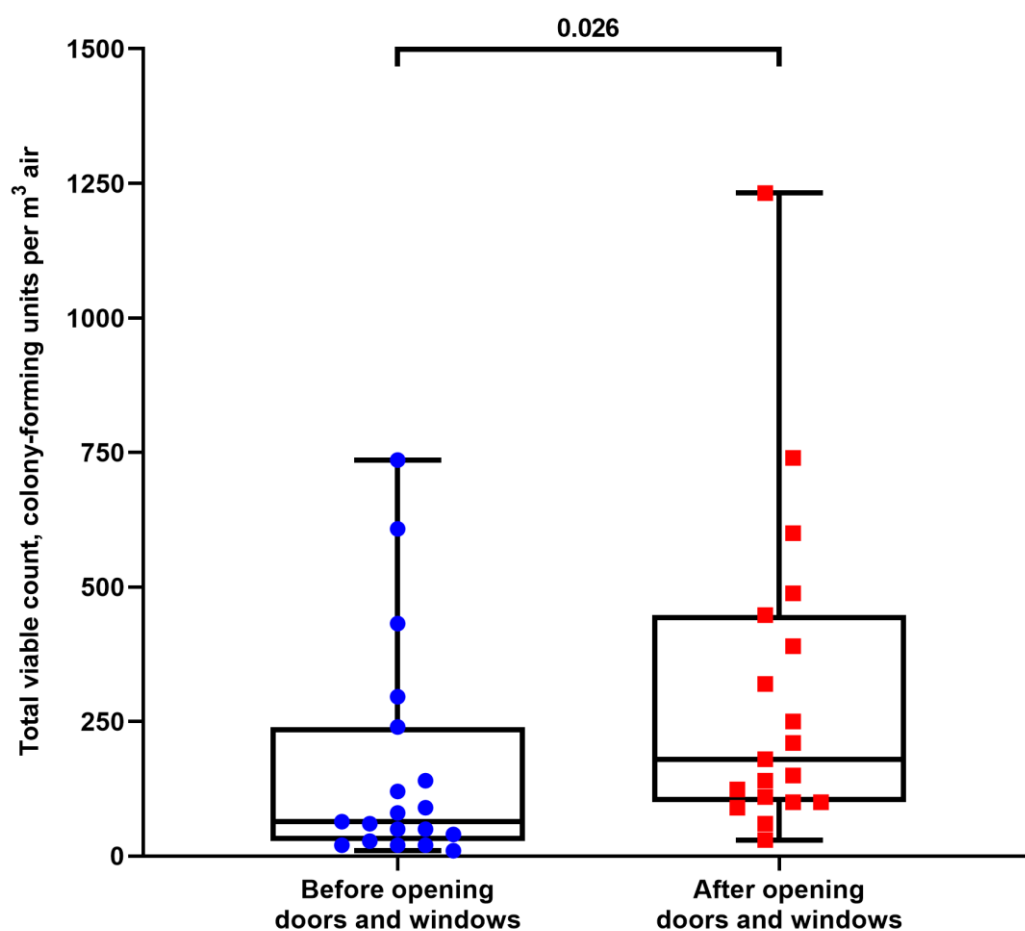


Figure S1. Total viable count in the hospital air before (blue circle dots) and after (red square dots) opening doors and windows. Each dot represents one air sample. *P* values provided above the boxes, Wilcoxon matched-pairs signed rank test.