**Characterising SARS-CoV-2 transmission via aerosols and effective sampling methods for surveillance**

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**Abstract**

**Background:** There is increasing evidence for aerosol-based transmission of SARS-CoV-2, with particulate matter (PM) a possible vector. Air surveillance is necessary to safeguard public spaces.

**Aim:** To characterise SARS-CoV-2 distribution in aerosols collected in hospital and public spaces and determine best sampling methods for surveillance.

**Methods:** Over 8 months in 2021, 8 samplers collected liquid bioaerosols and size-fractioned particulate matter(PM) in hospitals (ICU, Respiratory ward and communal waiting areas), a London railway and underground station, a university, and a primary school. RNA was extracted from samples and RT-qPCR targeting the N-gene of SARS-CoV-2 was performed. Samples were cultured on Vero cells.

**Results:** 209 air samples were obtained with 20 positive for SARS-CoV-2. 15 positive samples were from hospitals, 10 from outpatient waiting areas (ED waiting area, Chemotherapy Day Unit), 2 of which had the B.1.1.7 mutation (α-variant) on sequencing, and 5 positive samples from rooms housing SARS-CoV-2 positive patients on ICU and respiratory wards. 5 positive samples were obtained via a portable sampler on two separate journeys in a London underground carriage. SARS-CoV-2 was detected mostly in PM samplers (n=17) compared to liquid bioaerosol samplers (positive sample pick-up 13% vs 4%respectively), in fine particles ≤2.5ɥm(PM2.5) in diameter (n=14). No samples were cultured on Vero cells.

**Conclusion:** Size-fractioned particulate matter samplers may be more efficient than liquid bioaerosol samplers in detecting and monitoring SARS-CoV-2 in the air. SARS-CoV-2 is most detected on fine particles, giving support to PM2.5 acting as a vector for aerosol-based transmission.