Respiratory viral detection and whole-genome sequencing from COVID-19 rapid antigen test devices

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Background: Rapid antigen devices are an increasingly important diagnostic modality for infectious diseases, as seen for COVID-19. Genomic sequencing of SARS-CoV-2 has also had a major role in the public health response to COVID-19, clarifying viral transmission at global and local levels, and, importantly, in tracking the emergence of new variants. Opportunities for genomic characterisation of circulating viruses are increasingly limited, given a shift to rapid antigen devices. Here, we describe an approach for the whole-genome sequencing of SARS-CoV-2 and other respiratory viruses from rapid antigen devices, apply this technique to devices collected as part of clinical care.

Methods: Residual respiratory viral diagnostic samples were diluted in kit-supplied test buffer, before being applied to rapid devices and allowed to dry. Additional devices were collected from staff and patients at the Royal Melbourne Hospital. Devices were then opened using a blunt instrument and nucleic acid was extracted. For SARS-CoV-2, targeted amplification and genomic sequencing was achieved using the Midnight tiled amplicon approach. For other respiratory viruses, genomic sequencing was achieved using pan-viral sequence enrichment. State-of-the-art informatics approaches were applied to recreate viral genomes.

Results: Complete SARS-CoV-2 genomes were recoverable from the majority of positive SARS-CoV-2 rapid devices (55%; 66/121); stratifying by real-time PCR cycle threshold, we observed improved recovery for samples with Ct vales below 35 (68.0%; 55/81) compared to 35 and above (27.5%; 11/40). For samples negative for SARS-CoV-2 and positive for another respiratory virus (adenovirus, influenza, metapneumovirus, parainfluenza, picornavirus, RSV and/or seasonal coronaviruses), complete genomes of relevant taxa were recovered from the majority of sample (98/112; 87.5%), supporting viral subtyping and genomic surveillance.

Conclusion: This work provides a platform for characterisation of respiratory viruses, including SARS-CoV-2 and influenza, from rapid antigen test devices, and could form a valuable surveillance tool for pandemic preparedness.

Disclosure of Interest Statement: None.