Quantitative comparison of viral loads in self-sampled nasal and nasopharyngeal swab samples over the course of COVID-19 infection

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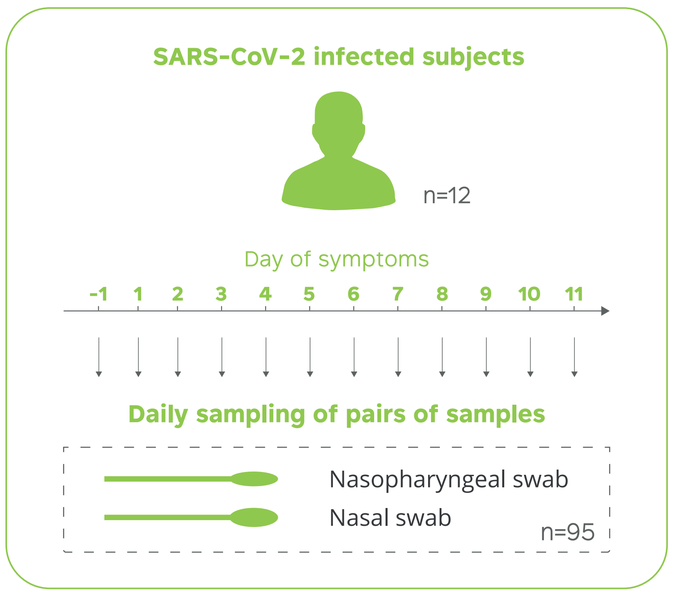
Introduction

Nasopharyngeal swab (NPS) has been the reference sample type for respiratory infection diagnostics. The coronavirus pandemic has led to increased sampling frequency and demand for more convenient sampling. Accordingly, nasal swab (NS) sample and self-sampling have gained favour in SARS-CoV-2 diagnostics. However, there is limited data on the performance of NS, especially, in correlation to the symptomatic day and viral load. We evaluated the viral load ratio and detection rate of NS to nasopharyngeal sampling.

Materials and methods

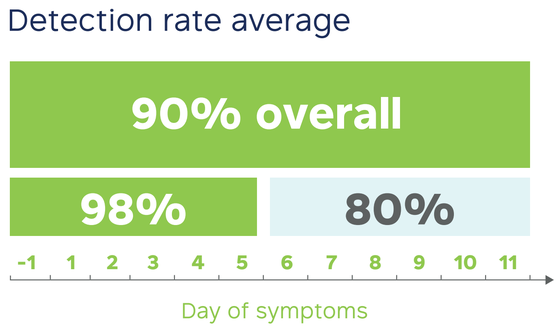
Individuals with SARS-CoV-2 infection were carefully instructed to voluntarily self-sample after having given informed consent. Swab sampling was instructed from the nasopharynx (approx. 10 cm depth, single nostril) and nose by rubbing both nostrils (nasal). The samples were analysed with an automated and quantitative mariPOC® SARS-CoV-2 antigen test (ArcDia International Ltd, Finland) designed for decentralised diagnostics. The samples were pretreated with mariPOC inactivation solution prior to suspending the swabs into mariPOC RTI sample buffer.

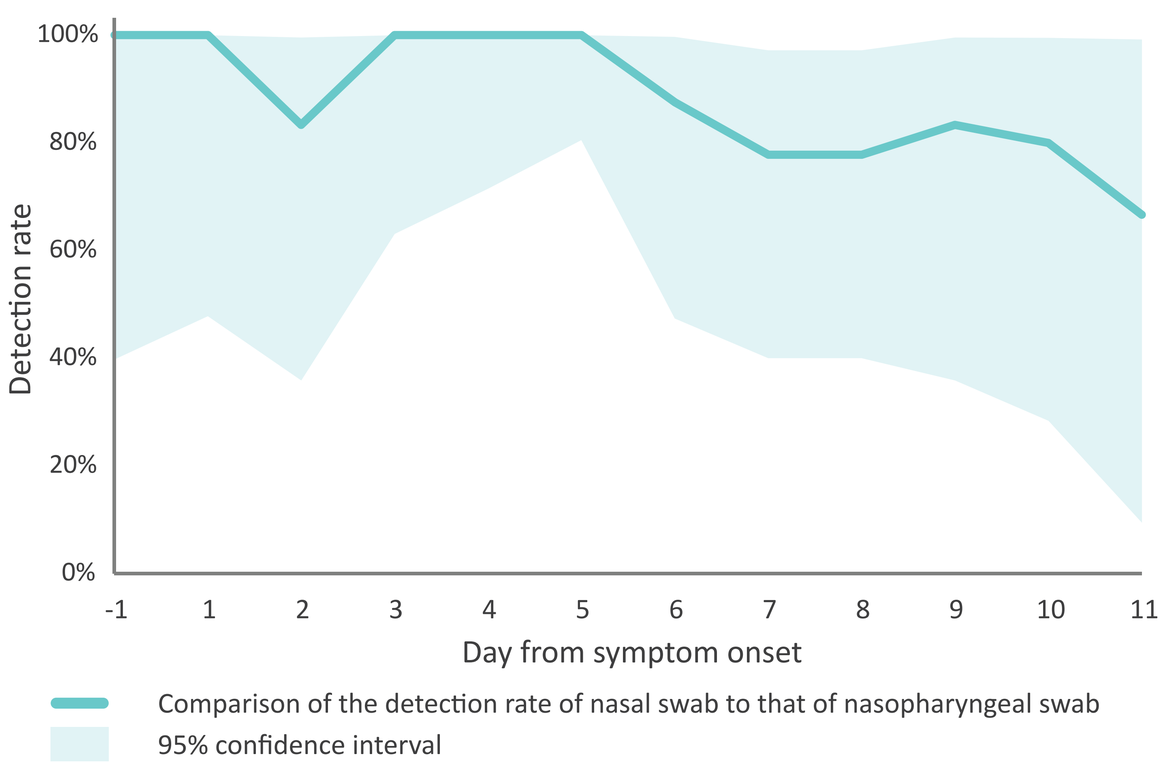


Results

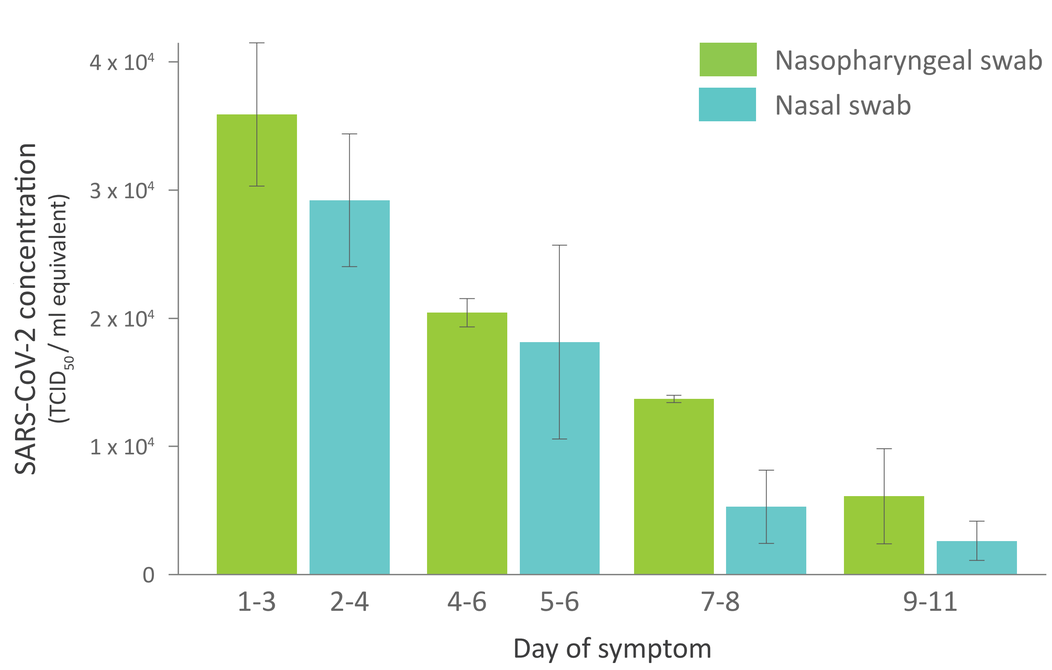
Detection rate of nasal swab versus nasopharyngeal swab

The detection rate of NS compared to that of NPS was overall 90%, and reached 98% between the pre-symptomatic day and symptomatic day 5. The detection rate between days 6 to 11 was 80%.





Viral load in nasal and nasopharyngeal swabs



The bars represent the average of virus concentration measured over ranges of symptomatic days anoted below. mariPOC test fluorescence signals were converted into virus concentrations ($TCID_{50}$/mL) against response obtained from reference SARS-CoV-2 preparation, NR-52287, BEI Resources, USA. The error bars represent the standard deviation.

The highest viral loads were on symptomatic days 1-3 in NPS, and 2-4 in NS. At the peak of the viral load, the virus concentration was on average $3.6x10^4$ $TCID_{50}$/ml in NPS and $2.9x10^4$ $TCID_{50}$/ml in NS. The viral loads remained high until the day 6 of symptoms in both NPS and NS.

Lower viral loads were measured in NS compared to NPS, and overall viral load decreased towards the end of the infection. This can explain the lower detection rate of NS compared to that of NPS after the day 6 of symptoms.

Conclusions

Nasal swab provides **excellent detection** of COVID-19 between **day -1 to 5**, and is **most robust** between **day -1 to 6**.

Nasal swab can be used at **any phase of the infection** with minor compromise in performance

Self-sampling is a **reliable way** of collecting samples for mariPOC rapid antigen testing