

Saliva-based and nasal swab PCR tests of Sars-Cov-2: A longitudinal study on testing agreement and duration of positivity among participants with different Sars-Cov-2 antigen exposures

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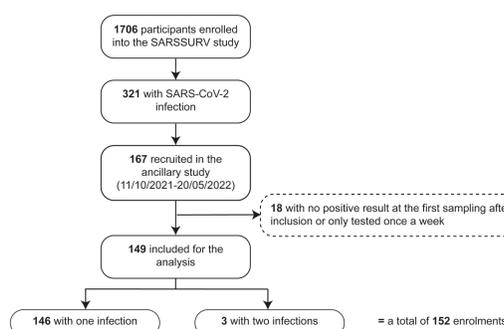
Introduction

Despite saliva test being considered as a non-invasive alternative to nasal swab in SARS-CoV-2 detection, research to date presents inconsistencies regarding the sensitivity between the two testing methods. In some studies, nasal swab showed a higher sensitivity and vice versa. The sensitivity of the saliva and nasopharyngeal swabs tests pose questions about cross-sectional studies on the agreement between the two tests, which collected data at only one single time. Studies addressing the agreement of the saliva and nasopharyngeal swabs over time is rather scarce. Another relevant and important question to ask is the duration of positivity as observed by both tests. Given the presence of symptoms and viral loads are predictors of sensitivity, a non-directional hypothesis can be put forward, i.e., the patients can remain tested positive longer with a saliva or a nasopharyngeal swab test.

To bridge this gap, we longitudinally followed 152 infected university students and staff members from the SARSSURV-ULiège cohort (Donneau et al., 2022) by collecting saliva and nasopharyngeal swab specimens twice a week throughout their period of viral shedding. The duration of positivity and agreement in the testing results between saliva and nasopharyngeal swabs were examined, defined as the number of days between the time of infection date (positive saliva test / declared infection) and the first of the two consecutive negative results, regarding both the saliva and nasopharyngeal swab tests. The event of interest was defined as participants tested negative after contracting COVID-19 and censored when the participants left the study before getting a negative test result or still stayed positive at the end of the study.

Method

Recruitment



Data collection

- A saliva and a nasopharyngeal swab samples were collected twice a week at the participant's home.
- The whole procedure was repeated until the participant get a negative result for both saliva and nasopharyngeal tests twice in a row.
- Only participants with at least one positive result for one of the two tests, namely saliva-based and nasal swab, were considered.

Statistical analyses

- Univariate and multivariate Cox proportional-hazard models;
- Cohen's Kappa and corresponding 95% CI together with agreement (in percentages);
- Univariate and multivariate fixed effect binary logistic regression models.

Conclusion

The results revealed that testing by nasopharyngeal swab resulted in significant longer duration of positivity. We observed fair agreement percentages between saliva and nasopharyngeal swabs, ranging from 62.3 to 81.5%. Participants' gender, hypertension, prior SARS-CoV-2 infection history were associated with agreement between the two tests.

The findings suggested a dynamic interaction of various types of antigen exposures and immunity, be it vaccination-induced, infection-induced or hybrid, which may lead to differences in participants' duration of SARS-CoV-2 detection.

The study, therefore, offered a plausible explanation to inconsistencies found in previous research and set the basis for further improvement and/or development of diagnostic testing techniques of SARS-CoV-2 and the like.

Reference

Donneau, A. F., Guillaume, M., Bours, V., Dandoy, M., Darcis, G., Desmecht, D., ... & Bureau, F. (2022). University population-based prospective cohort study of SARS-CoV-2 infection and immunity (SARSSURV-ULiège): a study protocol. *BMJ open*, 12(1), e055721.

Objective

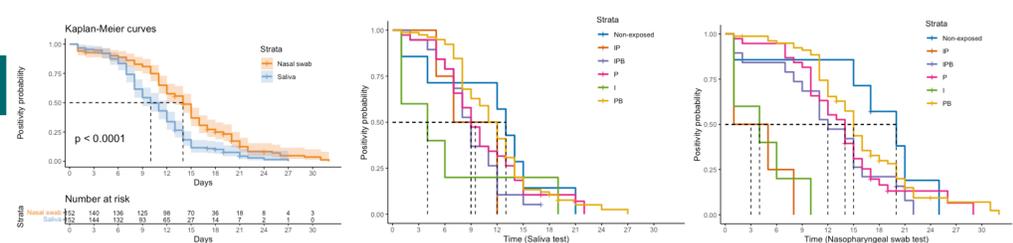
We conducted a longitudinal study to compare the agreement of results of saliva and nasopharyngeal swab-based PCR tests and the duration of SARS-CoV-2 positivity observed by the two methods.

Research questions

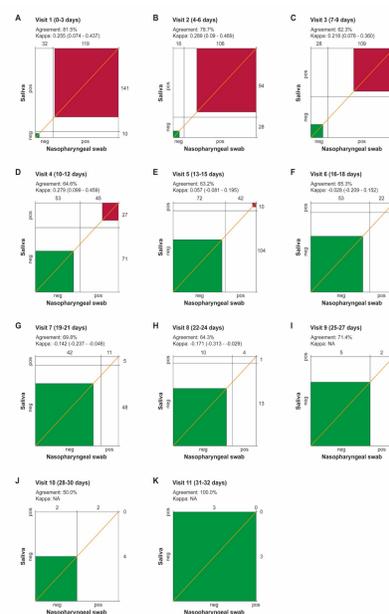
- RQ1. To what extent the results of the saliva and nasal swabs are in agreement over time?
- RQ2. To what extent the duration of COVID-19 positivity differs as a function of testing method, namely saliva and nasal swab?
- RQ3. What participants' and clinical characteristics are associated to the agreement in test results of saliva and nasal swabs over time?

Results

Time to negative testing



Agreement



Factors associated with agreement

Independent variables	OR (95% CI)	p-value
Age	0.992 (0.978 - 1.006)	0.268
Gender [Male]	1.702 (1.209 - 2.396)	0.002
Hypertension [Yes]	2.435 (1.203 - 4.929)	0.013
Group		
P	Ref.	
Non-exposed	0.736 (0.336 - 1.61)	0.443
IP	0.674 (0.231 - 1.97)	0.471
IPB	0.479 (0.278 - 0.827)	0.008
I	0.498 (0.174 - 1.426)	0.194
PB	0.783 (0.524 - 1.172)	0.235
Time interval		
0-3 days	Ref.	
4-6 days	0.748 (0.417 - 1.342)	0.331
7-9 days	0.339 (0.201 - 0.572)	<0.001
10-12 days	0.364 (0.205 - 0.649)	0.001
13-15 days	0.35 (0.202 - 0.605)	<0.001
16-18 days	0.359 (0.193 - 0.671)	0.001
19-21 days	0.452 (0.222 - 0.924)	0.03

Notes. Group abbreviations: I (Infected once); P (Primo-vaccinated); IP (Infected-Primo-vaccinated); PB (Primo-vaccinated-Boosted); IPB (Infected-Primo-vaccinated-Boosted).