

### Background

- Since December 2019, over 32 million confirmed SARS-CoV-2 infections in the United States (1)
- To limit spread at public health level and reduce morbidity and mortality at the individual level, widespread screening and diagnosis prioritized
- Major barriers to widespread testing of COVID-19 positive individuals:
  - Limited resources exacerbated during surge periods
  - Biosafety hazards
  - Invasiveness of nasopharyngeal (NP) swab testing

### Purpose

- To compare the diagnostic yield of using a sterilizing transport buffer (eNAT, Copan Diagnostics) vs standard viral transport media (VTM) across different non-invasive sample types using a composite positive standard.

### Methods

- Sub-study of an observational cohort study of recently PCR-confirmed COVID-19 positive patients at Rutgers' University Hospital which implemented universal SARS-CoV-2 screening

#### Inclusion criteria:

- Patients older than 18 years of age
- Tested SARS-CoV-2 PCR-positive using the hospital's NP swab PCR tests
- Written consent to participate.

#### Collection by trained study personnel:

- Baseline:** 1 NP swab, 2 oral swabs, 2 nasal swabs and a self-collected saliva sample
- Additional specimen sets from admitted patients:** 2 oral swabs, 2 nasal swabs, and saliva samples every 2-3 days until discharge
- Each collection: 1 nasal and oral swab each immediately placed in 3 mL of eNAT while other set of swabs placed in viral transport medium (VTM) solution
- Samples tested within 48 hours of collection by Xpert Xpress SARS-Cov-2 (Cepheid, Sunnyvale, CA), a rapid point-of-care and widely available test (3)

### References

- WHO. WHO Coronavirus (COVID-19) Dashboard [Available from: <https://covid19.who.int/>].
- Banik S, Saibire K, Suryavanshi S, Johns G, Chakravorty S, Kwiatkowski R, et al. Inactivation of SARS-CoV-2 virus in saliva using a guanidium based transport medium suitable for RT-PCR diagnostic assays. medRxiv. 2021:2021.01.15.21249891 doi: [10.1101/2021.01.15.21249891](https://doi.org/10.1101/2021.01.15.21249891).
- Loeffelholz MJ, Alland D, Butler-Wu SM, Pandey U, Perno CF, Nava A, et al. Multicenter Evaluation of the Cepheid Xpert Xpress SARS-CoV-2 Test. J Clin Microbiol. 2020;58(8) doi: [10.1128/jcm.00926-20](https://doi.org/10.1128/jcm.00926-20).

### Results

- Between June 12<sup>th</sup> to October 23<sup>rd</sup>, 2020, 116 samples collected from 70 subjects. Total sample collection and study flow shown in Figure 1
- 84 sample sets from 52 subjects** included in analysis population.

Figure 1. Study flowchart of sample sets

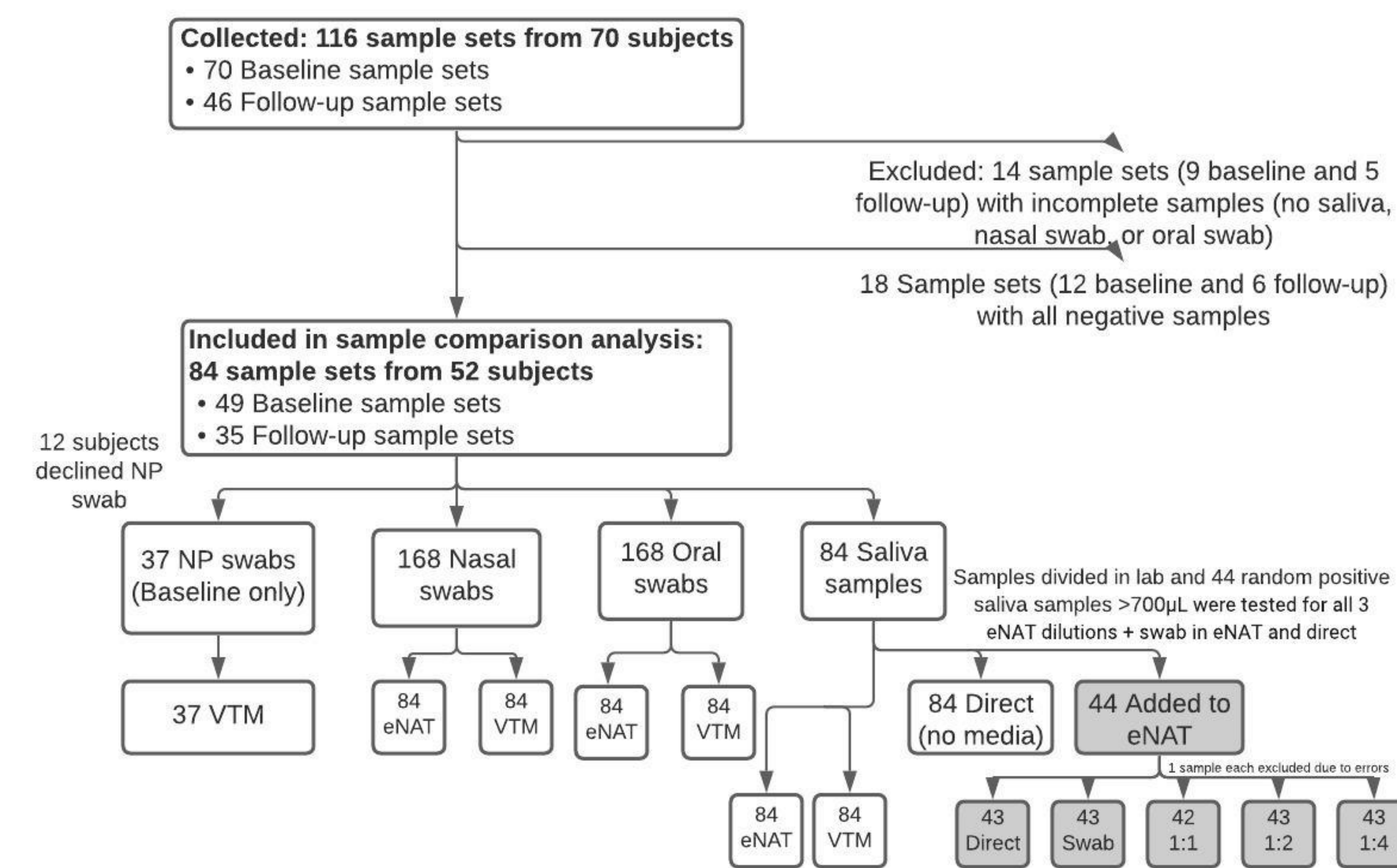


Table 1. Characteristics of participants in analysis population (participants with at least one study sample positive for SARS-CoV-2). Analysis population consisted of 21% asymptomatic, 17% mild-moderate, and 62% severe symptomatic.

	Analysis population (N=52)
<b>Mean Age in years (SD)</b>	55 (15.1)
<b># of Men (%)</b>	33 (63%)
<b># of Women (%)</b>	19 (37%)
<b>Ethnicity (%)</b>	
Hispanic	35 (67%)
Black	15 (29%)
White	2 (4%)
<b>Comorbidities</b>	
Hypertension	27 (52%)
Diabetes Mellitus	16 (31%)
Coronary Artery Disease	7 (13%)
Chronic Kidney Disease	4 (8%)
Lung Disease (eg, COPD)	8 (15%)
No chronic disease	19 (36%)
<b>COVID symptoms (%)</b>	
Cough	33 (64%)
Shortness of breath	32 (62%)
Fever	31 (60%)
Diarrhea	13 (25%)
Chest Pain	10 (19%)
No COVID symptoms	11 (21%)
<b>Oxygen Support Required (%)</b>	
None	20 (38%)
Nasal Canula	29 (56%)
Non-Invasive Mechanical Ventilation	2 (4%)
Intubation	1 (2%)
<b>Symptom duration prior to baseline collection Mean (range)</b>	7 days (1 – 23 days)

### Results, continued

Comparing percent positive rates across the different sample types (Fig. 2a):

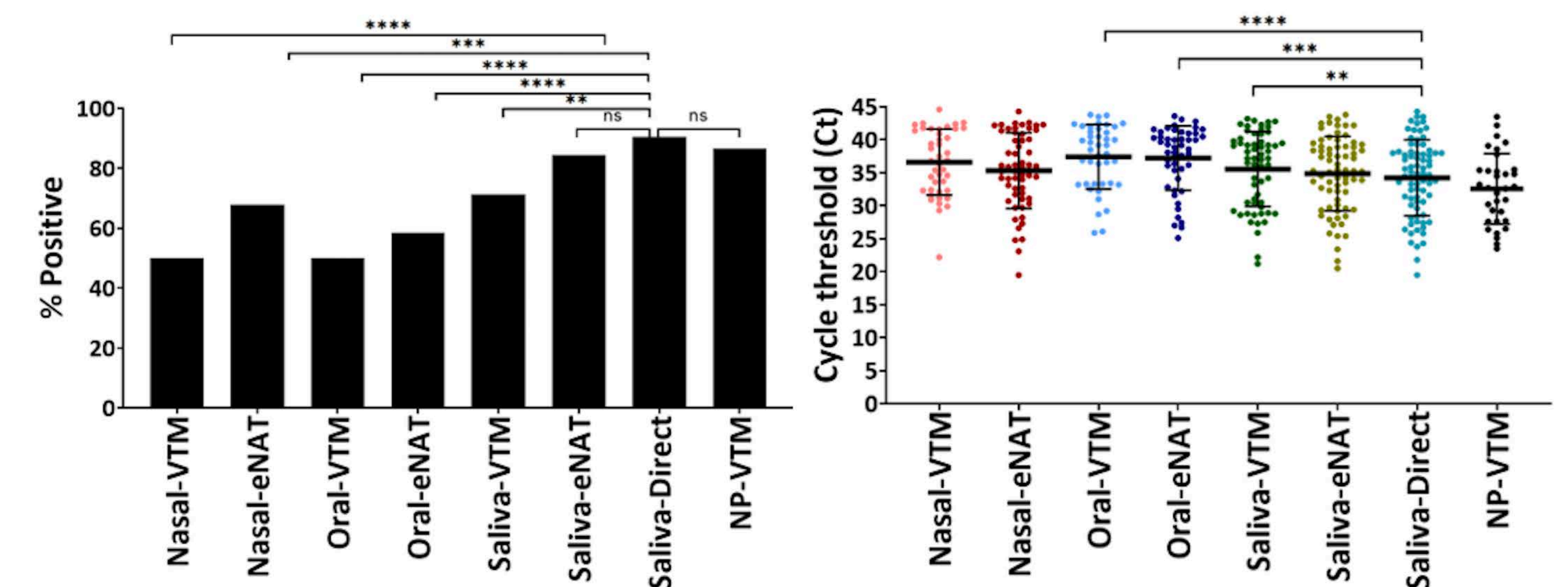
- Undiluted saliva (direct) rate: 90.5% in VTM (76/84)
- NP-VTM rate: 86.5% (32/37)
- Saliva in eNAT buffer rate: 84.5% (71/84)
- Saliva and NP swabs had significantly higher detection rates than nasal or oral swabs (P<0.0001)
- Oral swabs:** 6% increase with eNAT (42/84 vs 47/84, P=0.43)

NAT vs. VTM impact on detection across all sample types (Fig. 2b):

- Nasal swabs:** 20% increase with eNAT (40/84 vs 57/84 P=0.008)
- Saliva:** 12% increase with eNAT (60/84 vs 70/84, P=0.065)

Figure 2. Comparative testing of different respiratory specimens using the Xpert Xpress SARS-CoV-2 test.

(A) Percent positive rate and (B) N2 gene cycle threshold (Ct) values of samples from all participants with at least one SARS-CoV-2 positive sample (N=84 for all samples and N=37 for NP swab). NP=Nasopharyngeal; VTM=Viral transport medium; eNAT™= eNAT™ transport media, Copan diagnostics. ns=not statistically different. \*\*\*\* P<0.0001; \*\*\*P<0.001, \*\*P=0.02



### Discussion

- Saliva is comparable to NP swabs as sample specimen for Xpert Xpress SARS-CoV-2 test and more sensitive than oral and nasal swabs.
- eNAT increased sensitivity of detecting SARS-CoV-2 RNA by RT-PCR among all non-invasive sample types.

#### Limitations:

- Hospital population potentially less generalizable to ambulatory individuals, though some asymptomatic and mild patients included
- Discordancy between number of contemporaneous NP swabs and saliva due to subjects declining NP swabs
- eNAT solution added to saliva in lab- decreased real world replicability, but optimized protocol to test saliva in eNAT for future use as transport media

#### Conclusions:

- Self-collected saliva and use of eNAT as a sterilizing transport buffer can enhance yield, accessibility, and biosafety of rapid COVID-19 testing by RT-PCR

### Acknowledgements

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