Ruling out SARS-CoV-2 infection by electronic nose in a public health setting

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Aim

To determine the diagnostic accuracy of exhaled breath analysis by eNose for the discrimination between participants with and without a SARS-CoV-2 infection in a real-world population in the public health care domain.

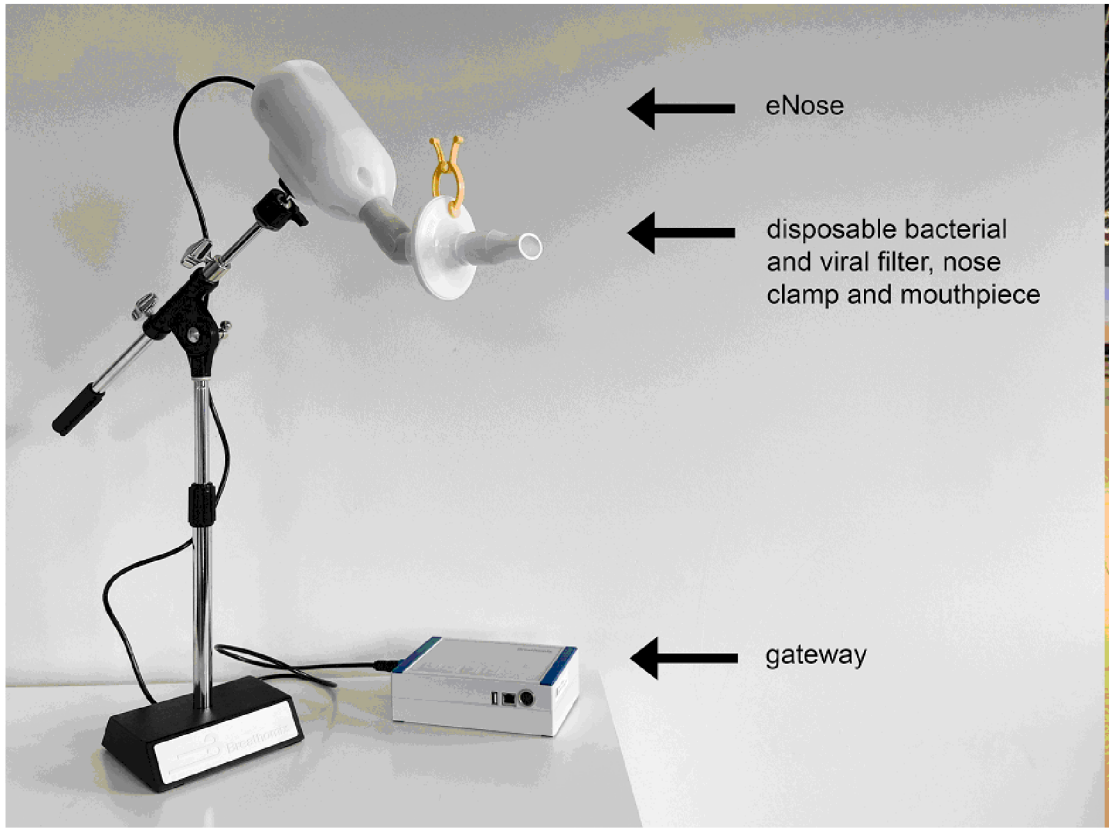
Design:

Prospective, real-world study including clinical follow-up 30 days after inclusion.

SARS-CoV-2 infection (reference):

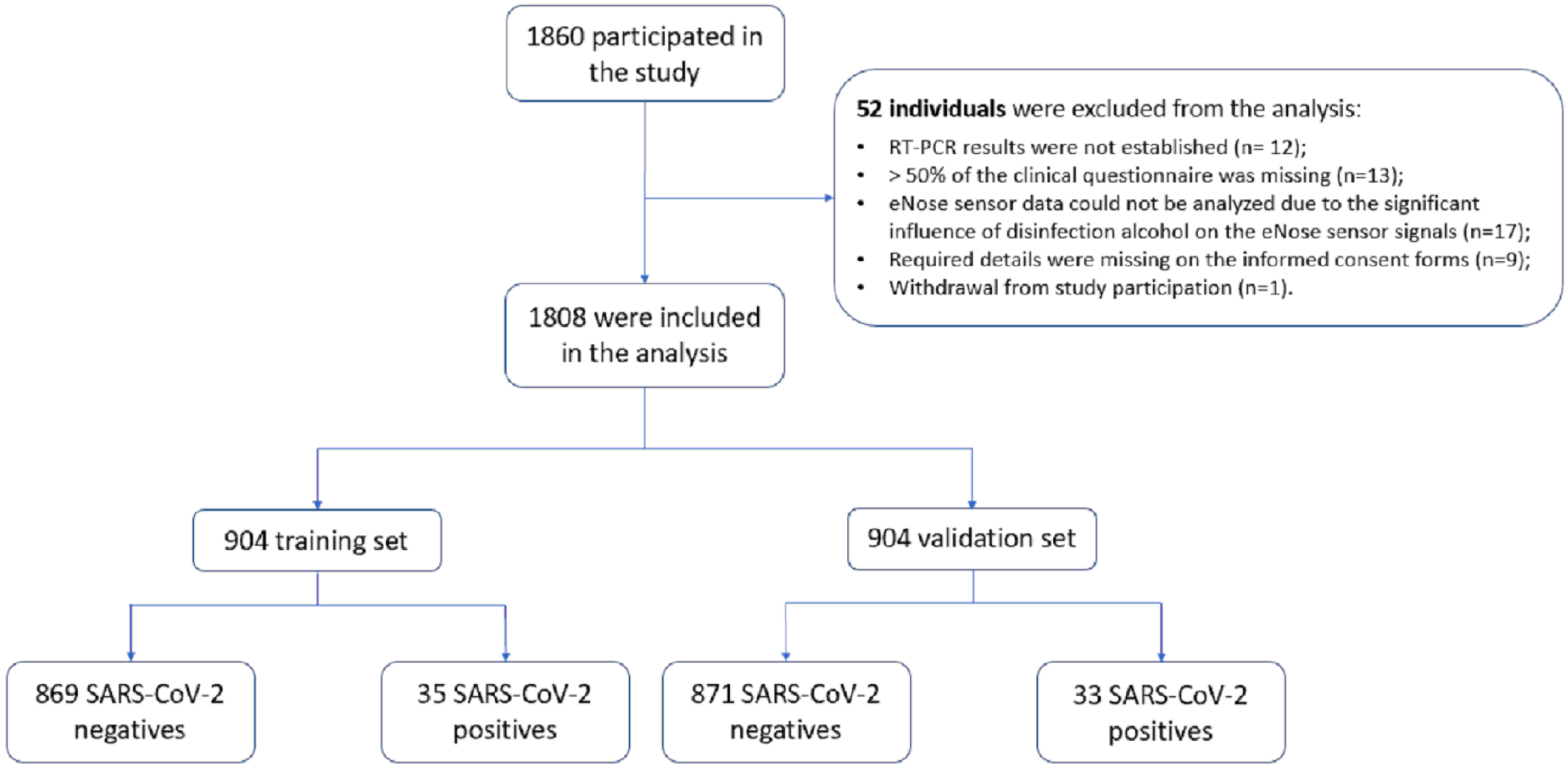
- TMA/PCR positive at inclusion (GGD test)
- Positive TMA/PCR within 7 days after study inclusion (any other health care institution)

Breath test for ruling out SARS-CoV-2





Participant enrolment



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	Training set		Validation set	
	SARS-CoV-2 positive (N=35)	SARS-CoV-2 negative (N=869)	SARS-CoV-2 positive (N=33)	SARS-CoV-2 negative (N=871)
Male sex, no.(%)	12 (34)	398 (46)	21 (64)[a]	381 (44)[a]
Age (years), mean (SD)	27.8 (8.2)	33.3 (12.2)	31.2 (12.2)	33.3 (13.1)
BMI, mean (SD)	22.0 (2.9)	23.4 (5.5)	24.2 (2.5)	23.3 (3.5)
Smoking (never/ex/current)	19/5/11[a]	455/190/224[a]	14/8/11[a]	448/181/242[a]
Pack years, mean (SD)	0.8 (2.2)	2.5 (7.4)	1.0 (2.0)	2.3 (6.5)
Asymptomatic, no. (%)	3 (9)	133 (15)	5 (15)	149 (17)
Fever, no.(%)	1 (3)	69 (8)	1 (3)	76 (9)
Comorbidity, no.(%)	4 (11)	141 (16)	6 (18)	135 (16)
VAS Dyspnea, mean (SD)	13.4 (15.5)	13.9 (19.1)	18.6 (25.0)	12.9 (17.6)
VAS Cough, mean (SD)	24.5 (19.8)	15.9 (19.5)	27.0 (27.6)	16.2 (19.9)

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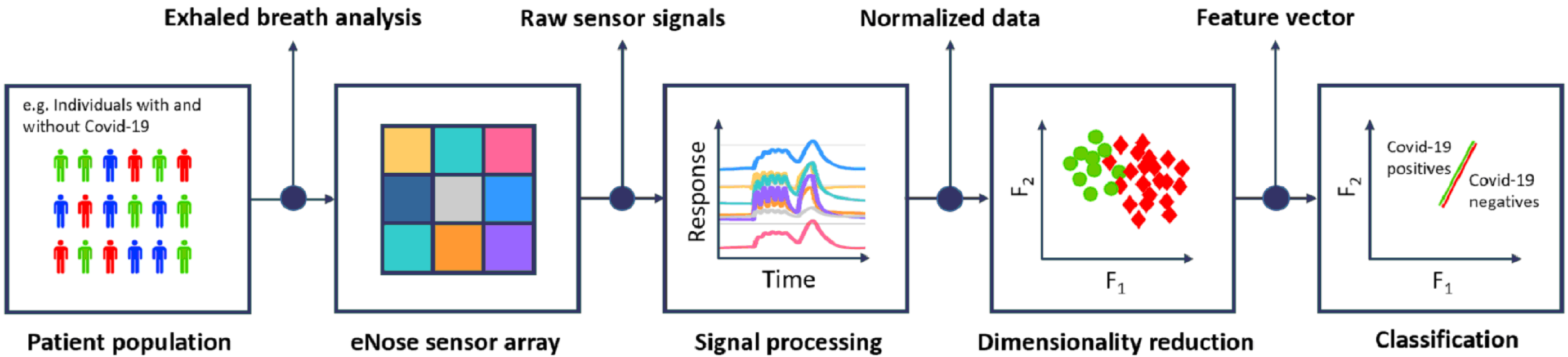
Analysis



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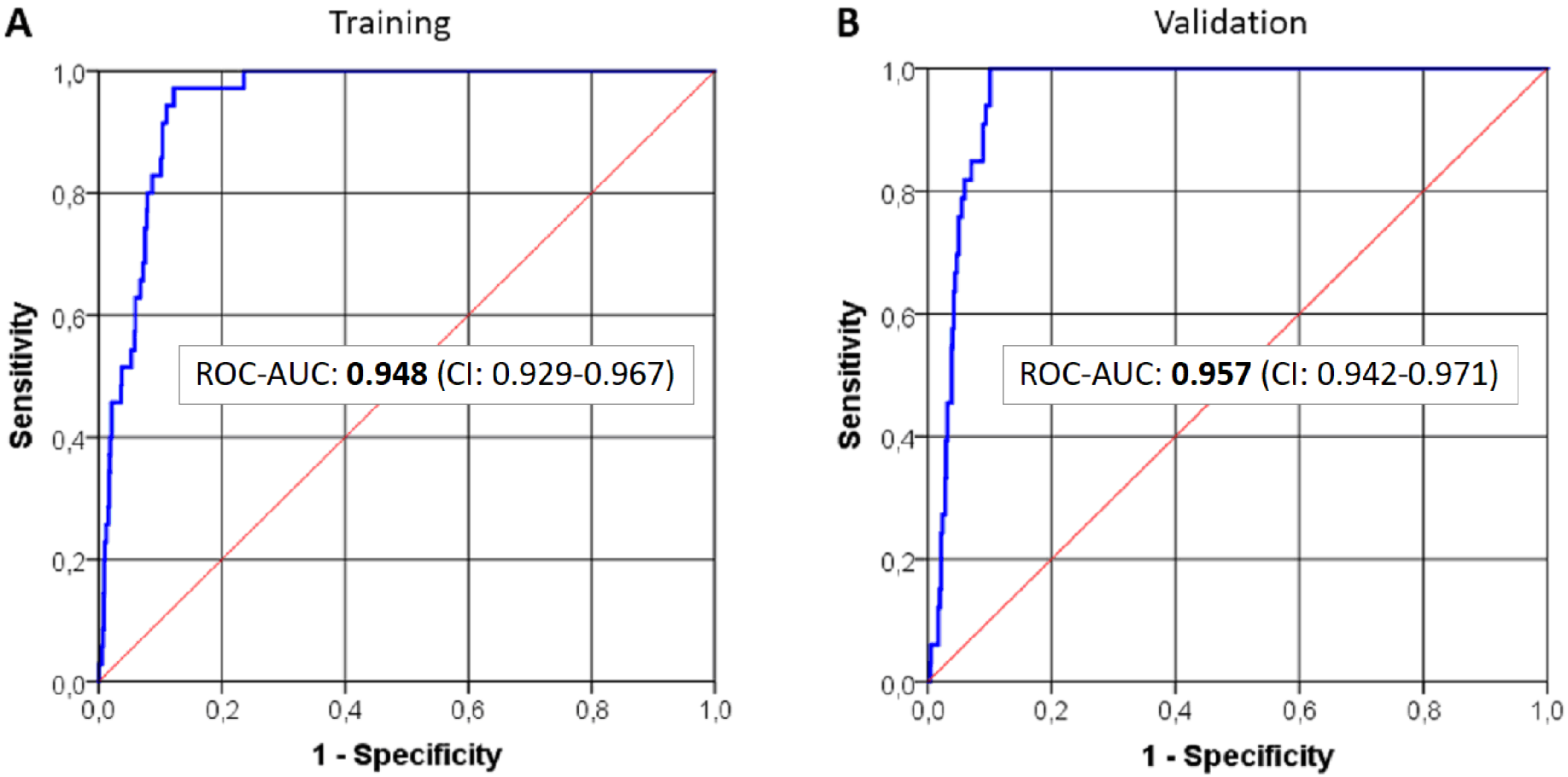
Results



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The diagnostic model

The diagnostic model was built on data obtained in the *training* set.

Percentage score for SARS-CoV-2 infection =

In the *training* set we identified cut-off points with approximately 100%, 97.5% and 95% sensitivity and calculated the sensitivity, specificity, PPV and NPV for these cut-off points in the *validation* set.

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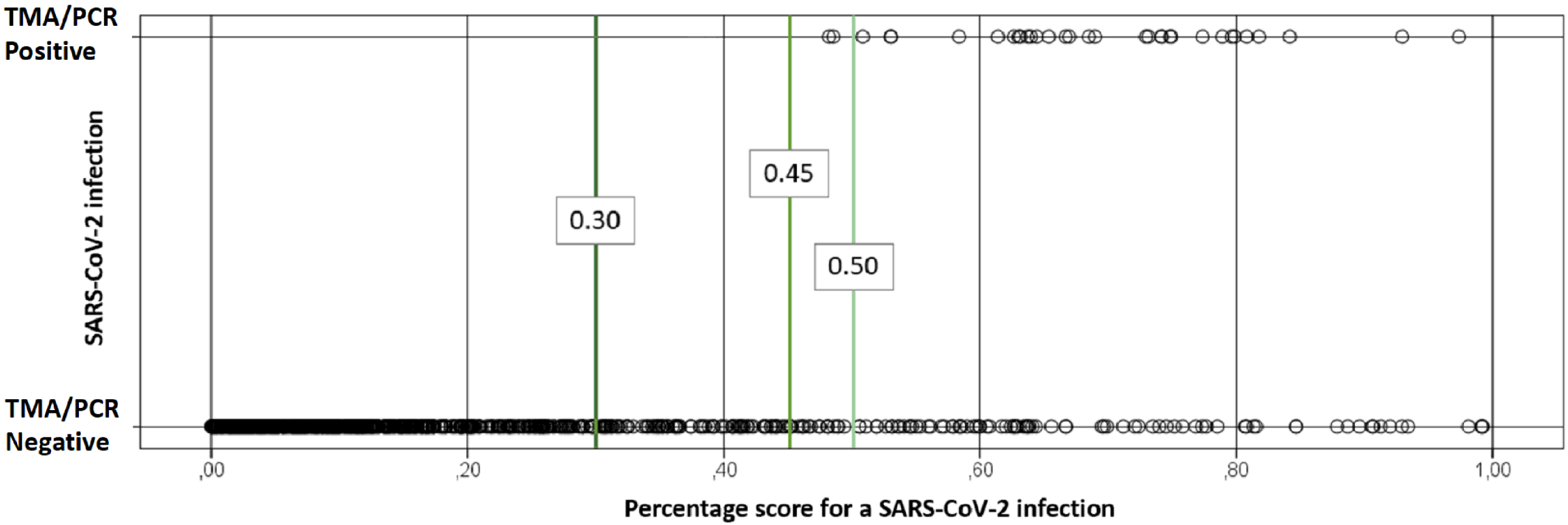
Results – Validation set



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Results – Validation set

Cut-off point	N < Cut-off point	Sensitivity (95% CI)	Specificity (95% CI)	PPV (95% CI)	NPV (95% CI)	FP	FN
0.30	681 (75%)	100% (0.89-1.00)	78% (0.75-0.81)	15% (0.10-0.20)	**100% (0.99-1.00)**	190	0
0.45	769 (85%)	100% (0.89-1.00)	88% (0.86-0.90)	24% (0.17-0.33)	**100% (1.00-1.00)**	102	0
0.50	789 (87%)	94% (0.80-0.99)	90% (0.88-0.92)	27% (0.19-0.36)	**99.7% (0.99-1.00)**	84	2

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Conclusion & Implication

- eNose technology can distinguish between individuals with and without a SARS-CoV-2 infection with high accuracy
- Exhaled breath analysis by eNose represents a non-invasive method to reliably rule out a SARS-CoV-2 infection in the majority of subject in public health test facilities
- Individual results can be obtained within seconds based on real-time cloud computing

Discussion

- SARS-CoV-2 prevalence 3,8% (August 2020), real-world study
  - eNose reliably rules out SARS-CoV-2 infection in 75% (cut-off point 0.30; sensitivity 100%)
  - Choice of cut-off value
  - eNose can be used as screening tool
  - Potential application in different settings and populations
- New study cohort is being recruited (other GGD test centre, prevalence +/- 10-15%)
- Subgroup analysis (age, (a)symptomatic, other respiratory virus infections)

Thank you

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