

Validation of Selected Commercial Serological Assays for Diagnosis of COVID-19

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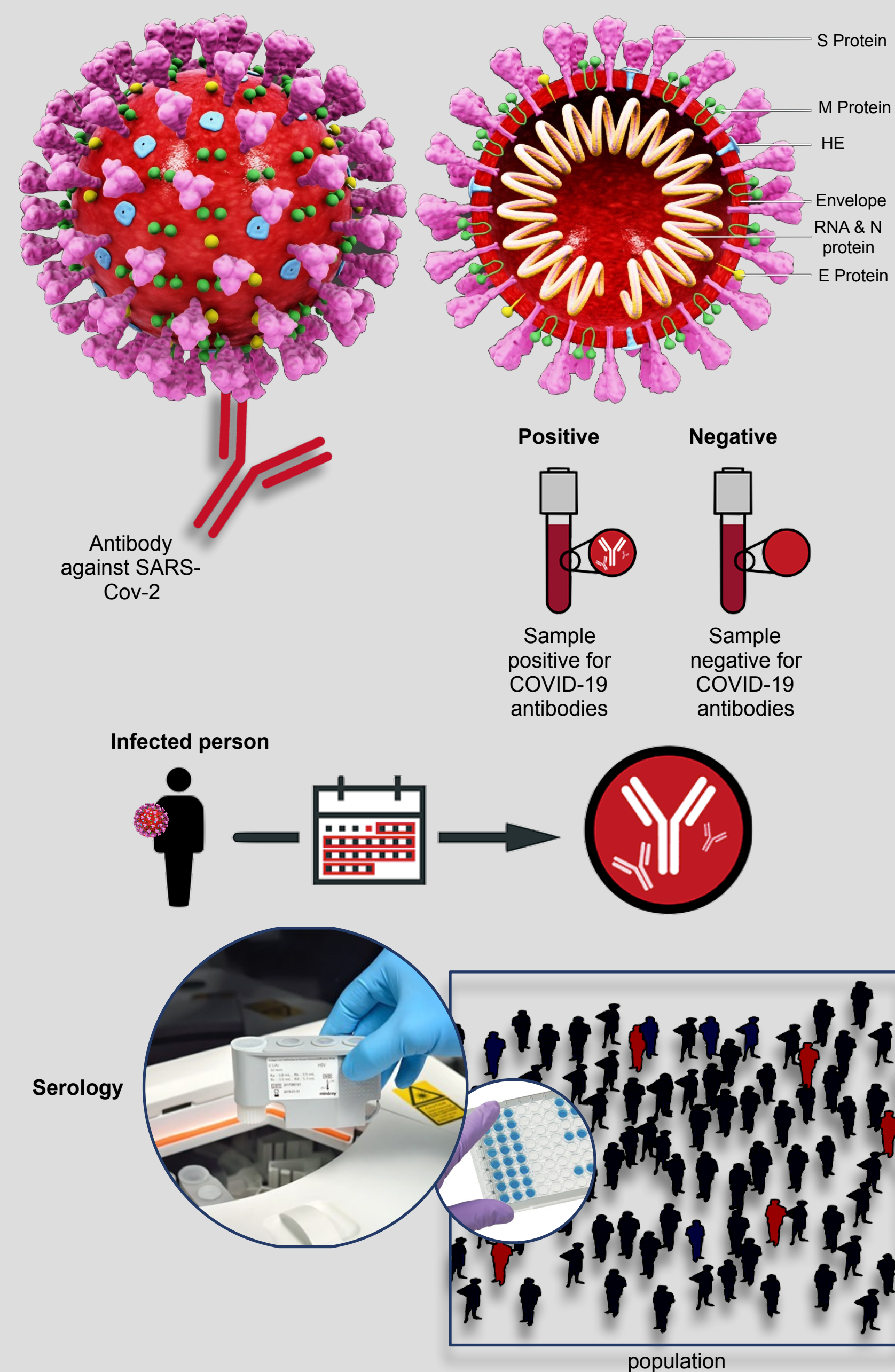
ABSTRACT

As researchers around the globe rush to put the available antibody tests to use, concerns have been raised about their precision. This study aimed to evaluate and compare the performance of selected commercial & automated serological assays, that are widely used in different clinical settings in Qatar. We validated the performance of five commercial IgG and IgM ELISA kits, three fully automated immunoassays, and two commercial rapid tests. The sensitivity of all assays was compared to RT-PCR and a surrogate virus neutralization test (sVNT). In addition, cross-reactivity was investigated. Among the evaluated kits, Lionex IgG assay demonstrated the best performance (~88% sensitivity and ~99% specificity). All automated assays showed an excellent correlation with the neutralization test with an overall agreement of 93.6-98.5%. The rapid assays demonstrated a very good performance in detecting IgG antibodies (86.0-88.0% sensitivity and 98.0-100% specificity).

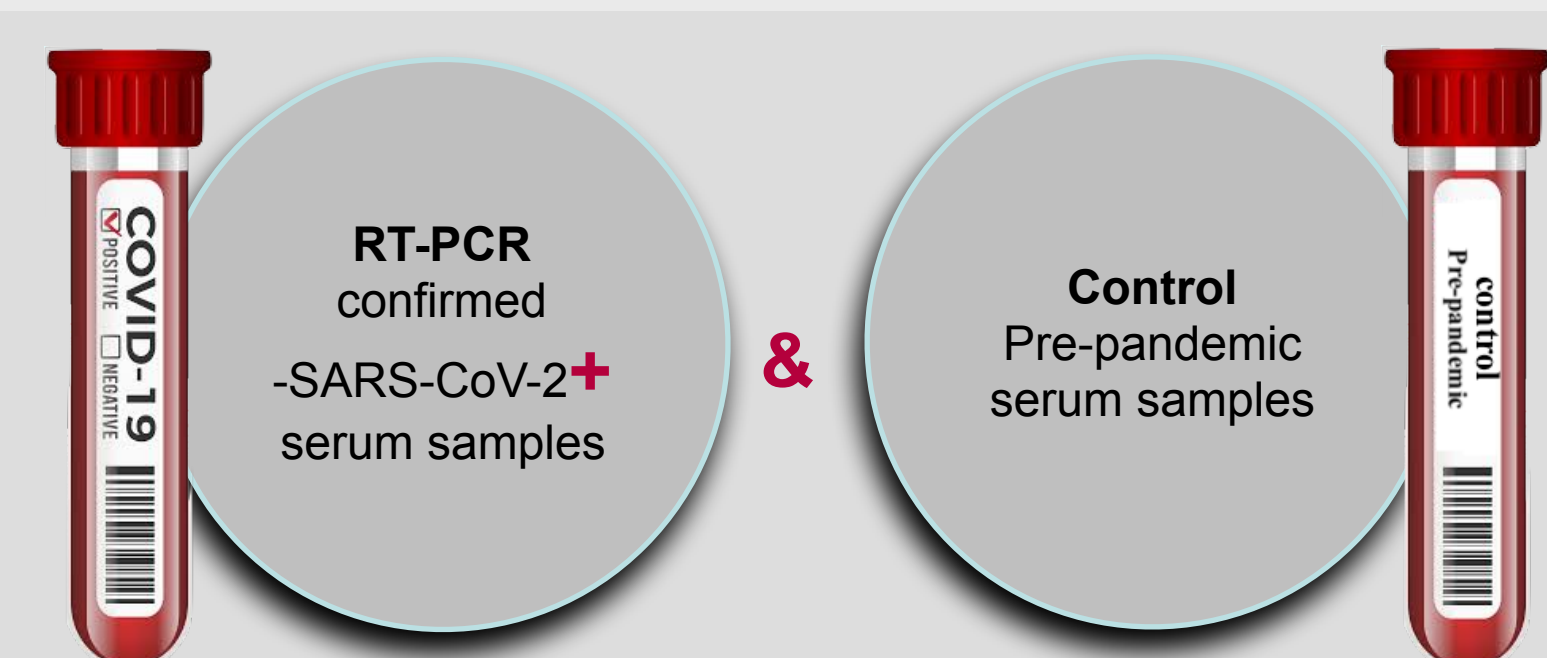
**ANTIBODY TEST
Covid-19**

INTRODUCTION

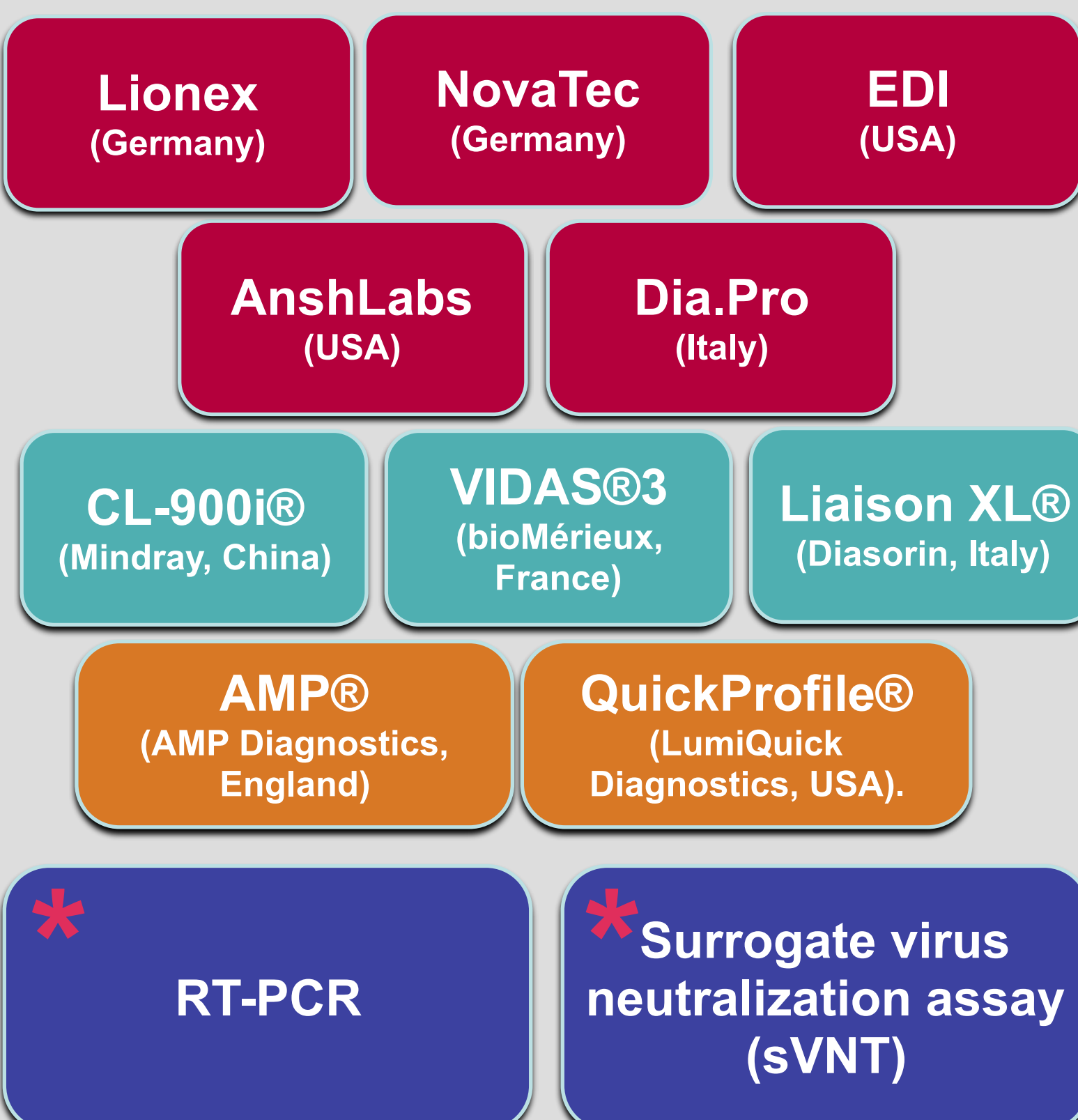
This study aims to evaluate and compare the performances of selected commercial and automated serological assays, that are widely used in different clinical settings in Qatar, for *in-vitro* diagnosis (IVD) of COVID-19, compared to RT-PCR and neutralization assay, and to establish the neutralization assay (sVNT) for detecting SARS-COV-2 neutralizing antibodies in Qatar.



METHODS AND MATERIALS



- 5 IgG and IgM ELISA kits
- 3 fully automated immunoassays
- 2 lateral flow assays (rapid tests).
- 2 Reference tests



RESULTS & DISCUSSION

Evaluation of five commercial IgG and IgM ELISA kits in comparison to RT-PCR and neutralization assay as reference tests
Lionex showed the best performance in detecting IgG antibodies and excellent correlation with the neutralization assay

Diagnostic efficiency	IgG ELISA				
	EDI	NovaTec	AnshLabs	DiaPro	Lionex
Sensitivity % [≤14 d]	62.2	77.1	82.2	63.3	77.1
Sensitivity % >14 d]	56.5	89.9	92.4	53.6	90.8
Overall sensitivity	58.4	84.8	89.1	57.5	87.0
Specificity	98.3	84.0	75.6	96.6	97.5
Diagnostic efficiency	IgM ELISA				
	EDI	NovaTec	AnshLabs	DiaPro	Lionex
Sensitivity % [≤14 d]	63.3	58.9	71.1	77.8	82.2
Sensitivity % >14 d]	17.4	16.8	15.2	89.1	51.6
Overall sensitivity	30.0	31.0	32.8	85.4	61.7
Specificity	99.2	95.0	94.1	89.1	88.2

Table 1. Diagnostic assessment of IgG/IgM ELISA. ≤14 d: ≤14 days post symptoms onset or post +PCR; >14 d: >14 days post symptoms onset or post +PCR

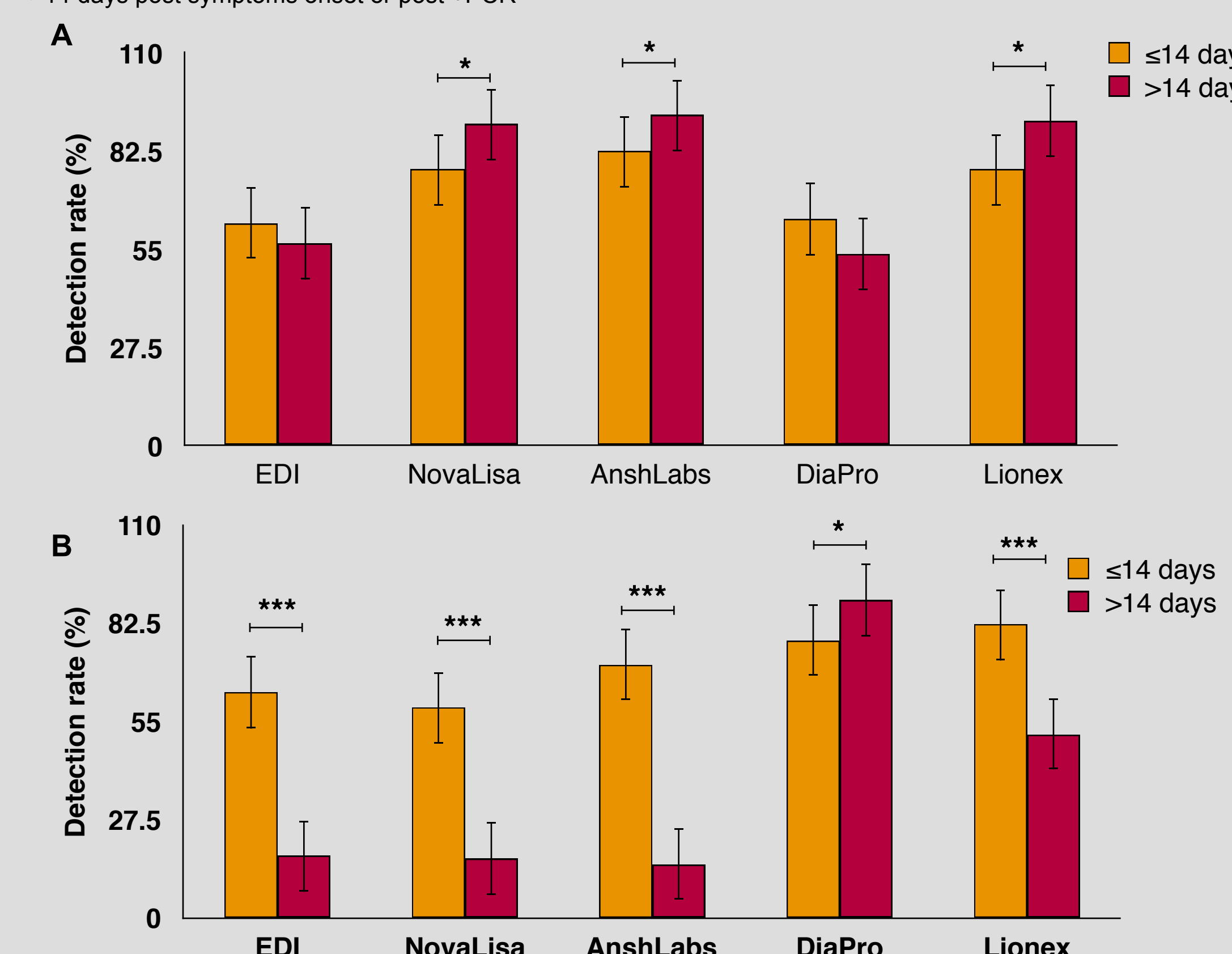


Figure 1. Sensitivity of the five commercial ELISA kits in samples collected ≤14 and >14 days post symptoms onset or positive PCR test. (A) IgG ELISA sensitivity; (B) IgM ELISA sensitivity.

Evaluation of three fully automated immunoassay analyzers in comparison to RT-PCR and neutralization assay as reference tests
Mindray CL-900i and *VIDAS 3* showed the best performance in detecting SARS-CoV-2 antibodies, and *Mindray CL-900i* showed the best correlation with the neutralization assay compared to *LIAISON XL*

Automated analyzer	Sensitivity (%)		Specificity (%)	
	IgG	IgM	IgG	IgM
Mindray CL-900i	93.5	39.0	95.2	100.0
VIDAS@3	90.9	46.8	98.4	100.0
LIAISON@ XL	87.1	-	100.0	-

Table 3. The diagnostic assessment of the different automated analyzers with RT-PCR

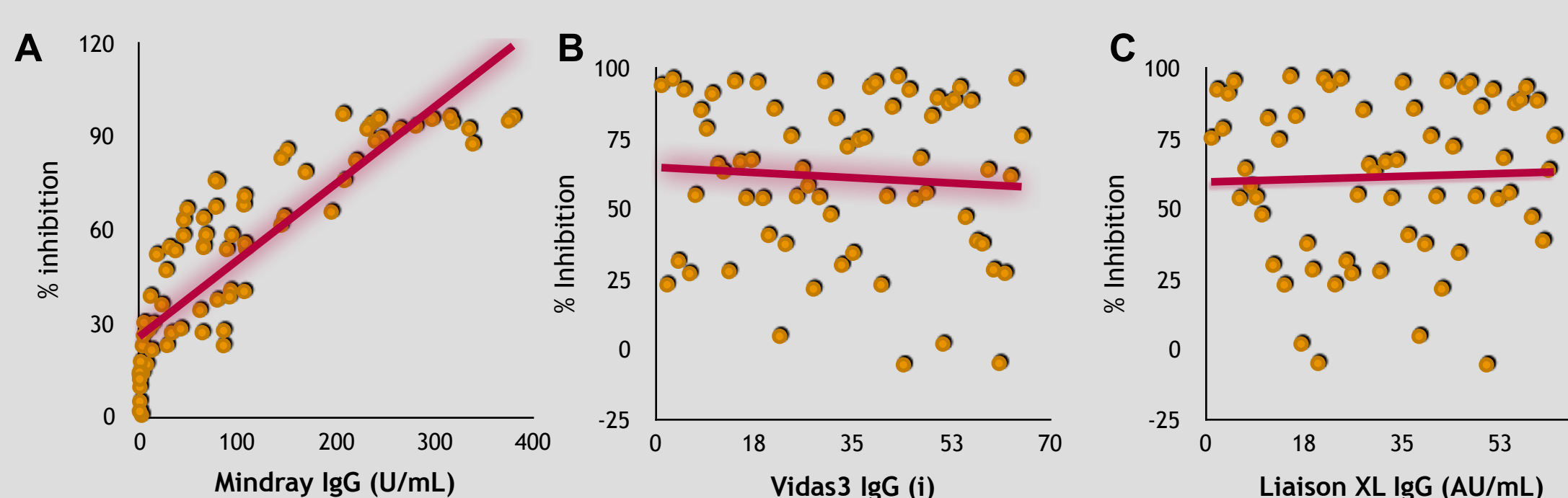


Figure 3. Correlation between each automated IgG assay and the sVNT % inhibition. (A) Mindray IgG; (B) Vidas IgG; (C) Liaison XL IgG

Reference test	Compared to	ORA (%)	PPA (%)	NPA (%)
Surrogate virus neutralization test (sVNT)	EDI IgG	78.4	98.2	43.8
	AnshLabs IgG	81.8	88.0	46.2
	Dia.Pro IgG	78.4	98.2	45.2
	NovaLisa IgG	80.7	90.0	44.4
	Lionex IgG	93.2	97.2	76.5
	EDI IgM	73.9	100.0	39.5
Surrogate virus neutralization test (sVNT)	AnshLabs IgM	69.3	92.6	35.5
	Dia.Pro IgM	88.6	92.0	69.2
	NovaLisa IgM	64.8	95.7	31.0
	Lionex IgM	78.4	92.2	41.7

Table 2. Concordance assessment of IgG ELISA with sVNT

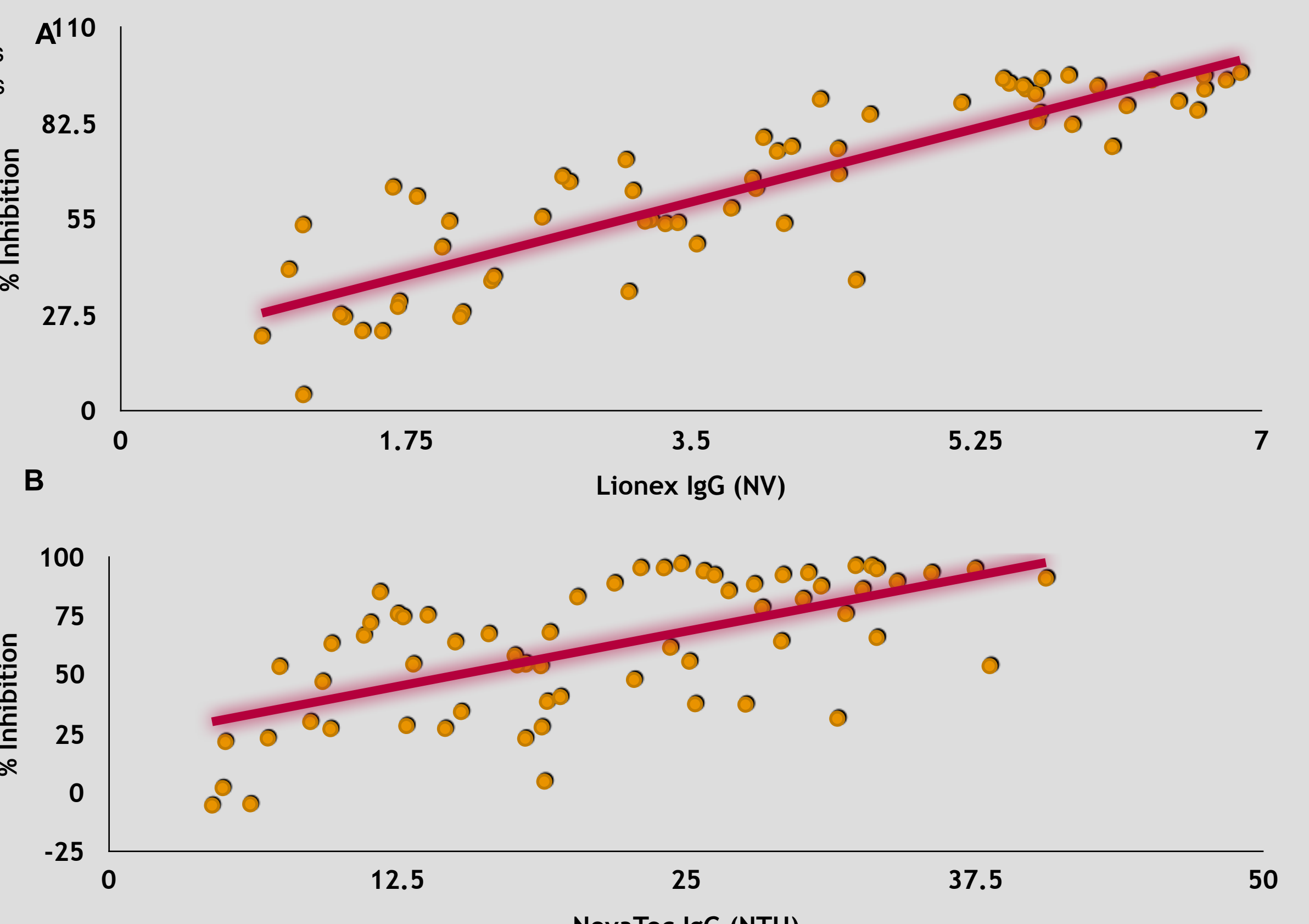


Figure 2. Correlation between IgG ELISA and the sVNT % inhibition. (A) Lionex IgG; (B) NovaTec IgG.

Evaluation of two lateral flow assay (LFAs) in comparison to RT-PCR and neutralization assay as reference tests
Both LFAs showed very good performance in detecting IgG antibodies. The overall agreement with neutralization assay was very good for both tests

Lateral flow assay (LFA)	Sensitivity (%)		Specificity (%)	
	IgG	IgM	IgG	IgM
QuickProfile™	88.0	10.0	98.0	88.0
AMP	86.0	53.0	100.0	100.0

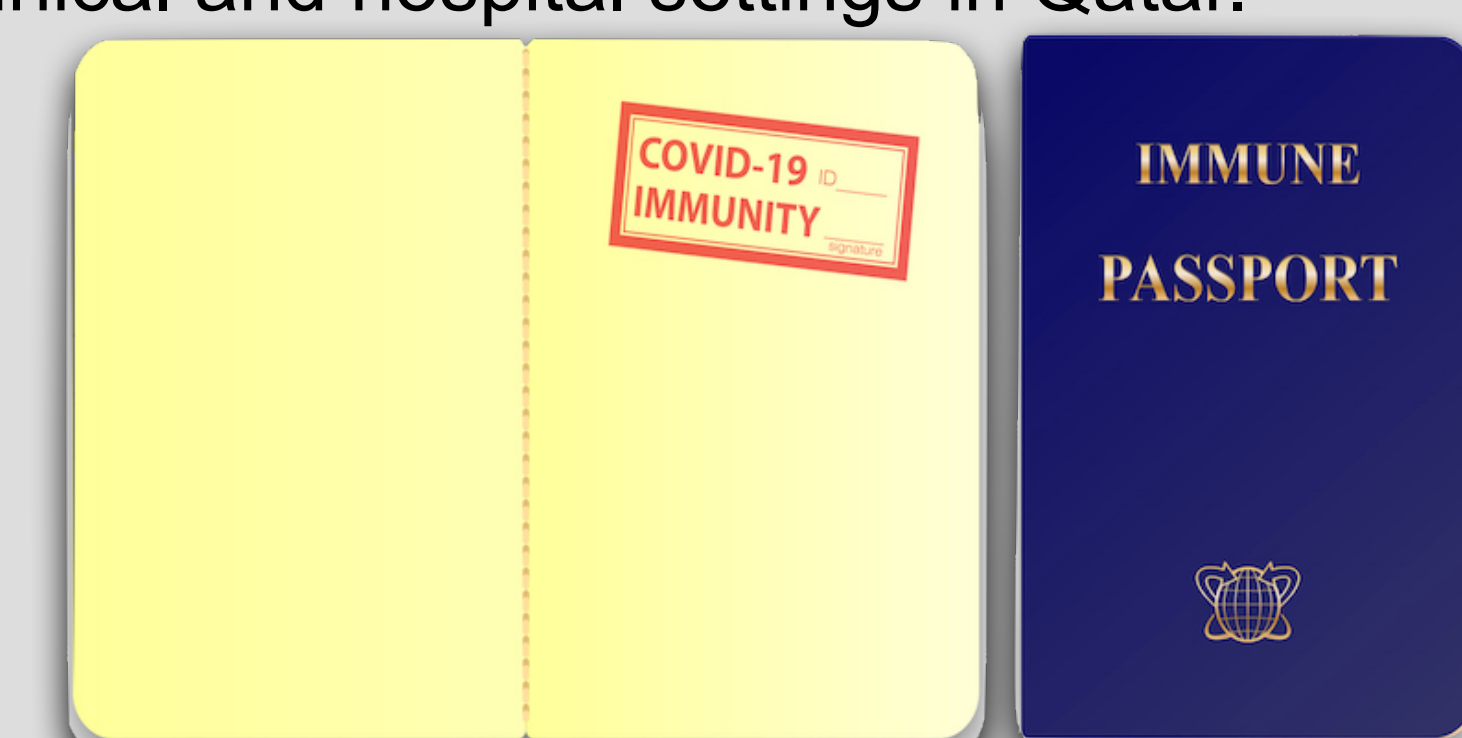
Table 4. The diagnostic assessment of the different lateral flow assays tests with RT-PCR

Lateral flow assay (LFA)	ORA (%)	PPA (%)	NPA (%)
QuickProfile™	96.7	96.7	0.0
AMP	92.9	97.5	0.0

Table 5. Concordance assessment of each rapid test IgG with the sVNT

CONCLUSION

- As the outbreak progresses in Qatar, the importance of serology testing has significantly increased.
- We have successfully validated a handful of selected serological assays that are widely used in different clinical and hospital settings in Qatar.
- This is considered a critical step for performing mass screening and epidemiological studies for the disease in the country using reliable serological assays.



Acknowledgements

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