Statistics Jersey

SARS-CoV-2: Prevalence of antibodies in Jersey

Statistics Jersey: www.gov.je/statistics

Preliminary analysis

Preliminary report notice

Due to the ongoing situation with regards the SARS-CoV-2 pandemic, Statistics Jersey have been asked to provide a preliminary analysis of the results of the recent antibody survey in time for a meeting of the Emergency Council. The survey fieldwork was completed on 5th May 2020, thereby resulting in limited time for analysis and quality assurance to take place.

This report should, therefore, be viewed as preliminary and potentially subject to revision once additional data checking and analysis have been conducted.

Summary

The Government of Jersey has recently conducted a survey of Islanders using Healgen COVID-19 IgG/IgM rapid test cassettes in order to estimate the prevalence of SARS-CoV-2 related antibodies in the Jersey population. Statistics Jersey did not conduct this survey but have been asked to provide an analysis of the results, which we present below.

Our key finding is that the estimated population prevalence rate of SARS-CoV-2antibodies is:

3.1% ± 1.3% (95% confidence interval)

This prevalence rate is in respect of the adult resident population living in private households in Jersey. The survey did not perform testing on any person aged under 16 years and did not include residents of communal establishments (such as care homes).

Due to the methods employed to obtain this estimate, there is a degree of uncertainty around the prevalence figure, in part reflected by the confidence intervals shown. However, the potential impact of non-response bias should also be considered. The survey achieved an estimated response rate of 65%; there was a significant level of non-response of those Islanders living in non-qualified accommodation.

The estimated prevalence rate implies that the total number of cases of SARS-CoV-2 that have occurred in households living in private accommodation was approximately 2,700. Whilst it is anticipated that there may be differences between this population and those who were excluded from this study, applying the estimated prevalence rate to the full Island population would equate to approximately 3,300 cases having occurred to date.

Whilst there exists a degree of uncertainty around these figures, the results of this analysis, and the above prevalence rate, are in line with the ongoing epidemic modelling currently being conducted.

Additional analysis is provided in respect of breakdowns of prevalence by broad age group and sex. The findings are detailed on page 4. Due to issues with the processes by which household address data was collected, we are unable to provide geographical breakdown; furthermore, the level of non-response in specific tenures precludes any meaningful analysis from this perspective.

Statistics Jersey will separately provide a quality assessment of the survey methodology, detailing recommendations for any proposed future rounds of testing.

Survey methodology

The survey was designed as a single stage cluster sample survey, with each cluster representing one Jersey private household and the individuals within households as the unit of interest. All individuals aged 16 and over who formed part of the selected household were asked to participate in the survey.

A list of 700 private addresses were randomly drawn from the Jersey Land and Property Register (JLPR) which formed the basis of the sample for this study. The sample drawn excluded communal establishments (such as care homes), commercial properties and a small number of other properties known not to be residential in nature.

Contact was attempted to be made with the households residing at the sampled addresses using two methods:

1. A letter (copy of which is contained in the annex) was sent to each address asking for the household to contact the Jersey coronavirus helpline in order to arrange an appointment at one of the testing centres.

2. The addresses were matched to the CLS "Populus" directory in order to try and determine contact details for any named individual who resided at that address. These individuals were then contacted by telephone by the helpline team, to arrange an appointment at one of the testing centres. Checks were made by the call maker to ensure that the individual contacted continued to reside at the selected address.

The antibody testing was conducted at three separate testing centres by health care workers who had received training on how to administer the point of care testing kits. The healthcare teams were supported by staff from other government departments. Provision was also made for a mobile testing team to attend households at their home address when they could not attend the testing centres in person (approximately 70 households were tested in this way). The results of the antibody tests were supplied to the participants together with a fact sheet detailing what the results meant (a copy of which is contained in the annex).

The results of the completed antibody test, together with basic demographic information collected at that time, were then input via a web-based form into a database. The data was subject to automated data cleansing at the time of capture. The data was then anonymised and passed onto Statistics Jersey for analysis.

Due to time constraints placed on the study, the time allocated for fieldwork was limited to 7 days (29th April to 5th May). This period included the time allocated to contact the household, arrange an appointment at the testing centre and conduct the testing process itself.

The survey obtained testing results from a total of 438 households and 855 individuals. These numbers equate to a response rate of 63% for households and an estimated 65% for individuals, once ineligible addresses (vacant properties) have been removed.

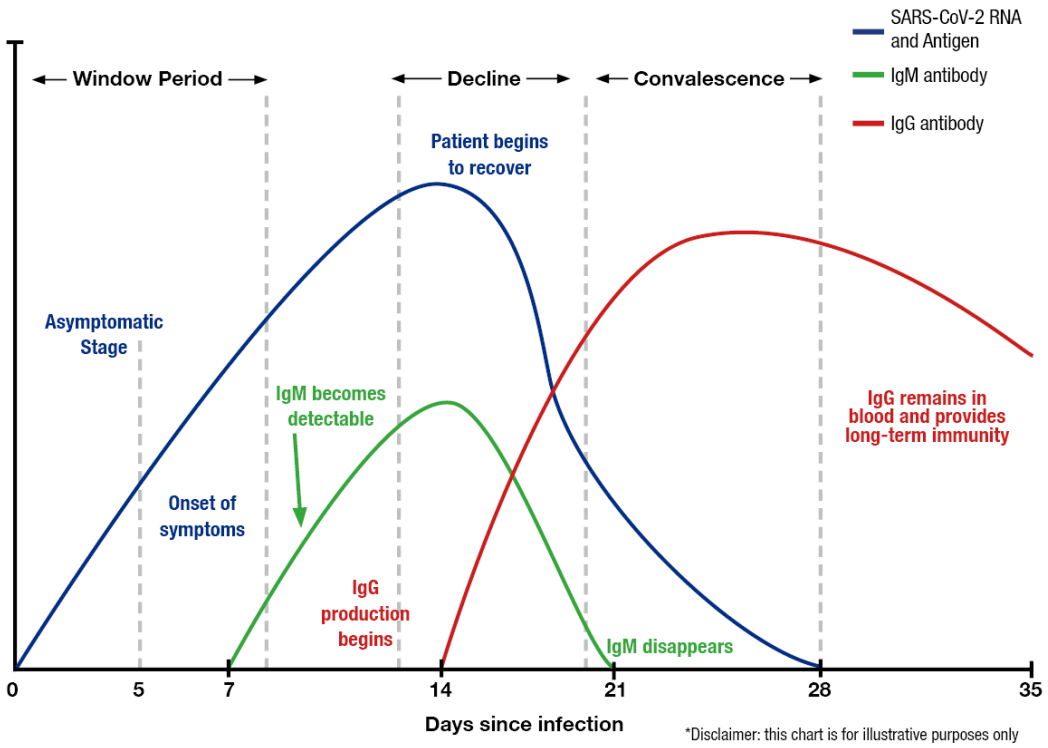
Details of test

Testing was conducted using lateral flow testing devices produced by Healgen Scientific. These devices are designed for the qualitative detection of SARS-CoV-2 antibodies using whole blood, serum or plasma. Testing for this study consisted of the sampling of whole blood obtained using a "pin prick" method administered by suitably trained healthcare professionals. Approval was obtained from the Ethics Committee for the conducting of the testing on Friday 1st May 2020.

The test devices themselves have been subject to testing, both internationally and locally by the Microbiology Department of the General Hospital. It is acknowledged that these devices have limitations; the manufacturer cautions that these devices "should not be used as the sole basis to diagnose or exclude SARS-CoV-2 infection or to inform infection status". The devices have relatively poor sensitivity (see details on measurement error later in this report); consequently, as many as 1 in 3 of those individuals tested may have a false negative test result. This sensitivity issue can, however, be compensated for in respect of the broad population monitoring that this study is aiming to achieve.

The test devices are designed to detect the presence of two types of SARS-CoV-2 antibodies, IgG and IgM. These antibodies are produced at different times in the infection cycle: IgM antibodies are typically detectable approximately 7-10 days after exposure and indicate acute SARS-CoV-2 infection is present; IgG production occurs later and suggests recent or past infection.

Figure 1 - Variation of the Levels of SARS-CoV-2 RNA and Antigen, IgM and IgG after infection – For illustrative purposes only, Source: http://www.diazyme.com/covid-19-antibody-tests



The test itself provides separate indications as to the presence of the two different antibodies. For the purposes of this initial analysis, a combined positive result has been used for estimating prevalence; a respondent who tested positive for either IgG or IgM antibodies (or both) was regarded as testing positive for the presence of SARS-CoV-2 antibodies.

It should be noted that there is currently no evidence regarding what / if any immunity the presence of IgG confers, or its longevity; the determination of immunity is not a part of this study. Instead, addressing the purpose of this study, the detection of these antibodies serves as an indication as to the level of infection that has taken place in recent months.

It is also important to note that due to the initial lag between infection and IgM becoming detected, some cases in their early stages of infection will not be detected. The resultant prevalence rate should, therefore, be considered as the prevalence as of around 24th April 2020.

Analysis and results

The study found that the overall prevalence rate of SARS-CoV-2 antibodies for the population of study to be:

3.1% ± 1.3% (95% confidence interval)

This prevalence rate is in respect of the adult resident population living in private households. The survey did not perform testing on anyone aged under 16 years and did not include residents of communal establishments (such as care homes).

There is a degree of uncertainty around the final figure which is in part reflected in the confidence intervals shown. The potential impact of non-response bias should also be considered - see later in this report for further details on potential sources of error.

This prevalence rate implies that the total number of cases of SARS-CoV-2 that have occurred within this population is approximately 2,700. Whilst it is anticipated that there may be differences between this population and those who have been excluded from this study, if this prevalence rate were to be applied to the full Island population, this would equate to approximately 3,300 infection cases having occurred to date.

These results are important to be seen in the context of the ongoing epidemic modelling currently being conducted. In particular:

- the level of implied infections experienced in Jersey is in line with that of the ongoing modelling work
- the baseline assumption for monitoring new cases of one positive test result likely equating to ten actual cases appears to have been reasonable

In addition to the overall prevalence rate in the population of interest, some basic demographic information for each of the participants was obtained and the following two tables show the resulting prevalence rates broken down by age and sex.

Table 1 – Prevalence rate by broad age group

Age group	Prevalence rate
16-34	3.0%
35-44	2.0%
45-54	0.6%
55-64	4.1%
65+	6.6%

There were no statistically significant differences (at 95% confidence level) between prevalence rates for different age groups.

Table 2 – Prevalence rate by sex

Sex	Prevalence rate
Male	3.7%
Female	2.5%

There are no statistically significant differences (at 95% confidence level) between prevalence rates between the sexes.

There were other explanatory variables potentially of interest. However, due to specific design and data quality issues with the survey, combined with the limited time constraints for this initial report, meaningful analysis of these has not been possible at this stage. In particular:

- breakdown by broad geographical area has not been possible due to ongoing quality issues with the processes by which addresses were recorded. This analysis would, however, have been limited in scope given the relatively small sample size used for this survey

- breakdown by tenure category has not been possible due to particularly high non-response in the non-qualified sector - see non-response error section for further details.

Potential sources of error / uncertainty

Non-response error

Adjusting for ineligible address, the survey obtained an overall response rate of 63% for households and an estimated response rate of 65% for individuals.

Compensation for non-response error in this analysis has been addressed using appropriate household-level and individual-level weighting. Specifically, weighting has been applied based on the characteristics of the Jersey population (as observed in the 2011 Census) using the following variables:

- age
- sex
- household size

In population and household surveys, Statistics Jersey would generally also weight responses by household tenure. This variable has proven to be an important weighting factor in such Jersey-based survey research as there are often significant differences in both response rates and the behaviour exhibited across the tenure categories, notably in the social housing and non-qualified sectors.

However, whilst the overall response rate to this survey was generally of an acceptable level, non-response from the non-qualified sector was particularly high. This may in part due to the methods employed to engage households in this survey and the time constraints imposed on the field work. As a result, weighting by tenure was not possible. Therefore, particular care should be taken when considering the results in the context of this particular tenure category.

The unweighted response rates for each of the variables used in weighting, together with the corresponding proportions from the 2011 Census, are detailed in Tables 3, 4 and 5 below.

Table 3 – Age (individual level) profile of unweighted survey response compared to the 2011 Census

	Percent	
	Survey	**Census 2011**
16-34 years	25	30
35-44 years	17	19
45-54 years	17	19
55-64 years	19	15
65 years or over	21	17
Total	**100**	**100**

Table 4 – Sex (individual level) profile of unweighted survey response compared to the 2011 Census

	Percent	
	Survey	**Census 2011**
Men	47	49
Women	53	51
Total	**100**	**100**

Table 5 – Household size profile of unweighted survey response compared to the 2011 Census

	Percent	
	Survey	**Census 2011**
1	15	16
2	33	36
3	20	20
4	20	18
5+	12	10
Total	**100**	**100**

Prior to weighting the observed prevalence rate was 2.9% and after weighting it was 2.6%.

It should be noted that it is not possible to completely control for non-response error as there may be characteristics that impact non-response that may also impact the prevalence rate in that population. This is a potential source of bias in the result that can be improved by achieving a higher level of response.

Sampling error

The sampling design used for this survey was that of cluster sampling, with a simple random sample of Jersey addresses being drawn in order to identify Jersey households (the clusters); within sampled households, all individuals (the subject of interest) were then asked to participate in the testing. The resultant sample consisted of 438 households and 855 individuals.

There was very little within cluster / household variance (most households either had all individuals test positive or negative). The resultant 95% confidence interval around the observed prevalence rate was:

Observed prevalence rate: 2.6% ± 1.2%

Measurement error

A key component of error / uncertainty within studies of this type is the level of accuracy of the testing instrument itself. Adjustment must be made for such measurement error in order to produce an estimate of the true population level prevalence. Any uncertainty in respect of the accuracy of the tests introduces additional uncertainty in the final estimates.

In order to assess the level of accuracy of the testing instruments, rather than relying on the manufacturer's claimed characteristics for the test, we have used the results of an independent assessment conducted by the World Health Organisation: "Clinical sensitivity and specificity of three rapid SARS-CoV-2 Antibody (IgM/IgG) Tests on a hospitalized patient cohort: InTec, Cellex and OrientGene". A copy of this report is included in the annex.

The testing instrument used in this study was the Healgen COVID-19 IgG/IgM Rapid Test Cassette, and was found to have the following characteristics:

Overall sensitivity: 83.33% (95%CI: 74.94% to 89.81%)
Overall specificity: 100% (95%CI: 66.37% to 100%)

In addition to the WHO assessment, the supplied test kits have been subject to a validation and verification process by the Microbiology Department of Jersey's General Hospital. The results of this work were:

Overall sensitivity: 76.47%
Overall specificity: 100%

The Jersey-based measures are both within the confidence intervals obtained from the WHO report.

For the purpose of this analysis, the sensitivity has been assumed to be that of the WHO report; the confidence intervals published in that report have been incorporated into our final estimates of uncertainty.

In respect of specificity, we have assumed a specificity of 100%, in line with the findings of the WHO report and the locally-performed validation. We have, however, not incorporated the WHO published confidence intervals for specificity into our final estimates of uncertainty. If these were incorporated, then the confidence interval of prevalence would encompass zero; indeed, if the actual specificity was 97% or below then the estimated population prevalence would be below zero.

Care should therefore be taken in interpreting these results, as any potential deviation from the specificity level of 100% would substantially lower the estimated prevalence rate. This uncertainty could only be resolved through large-scale additional testing of the testing kits themselves to provide additional certainty around the specificity level.

The observed prevalence is adjusted for the sensitivity of the test kits in order to provide an estimate for the true population prevalence. The overall estimated confidence interval for this measure incorporates both the estimated sampling and instrument measurement errors:

Estimated population prevalence rate 3.1% ± 1.3%

Annex

Please find attached:

1. Example letter sent to households asking them to participate in the survey:

   "COVID-19 community antibody testing programme – we need you!"

2. Leaflet supplied to all testing participants supplying information about their results

   "Information about your results"

3. World Health Organisation paper detailing performance of rapid anti-body tests

   "Clinical sensitivity and specificity of three rapid SARA-CoV-2 Antibody (IgM / IgG) Tests on a hospitalized patient cohort; InTec, Cellex and OrientGene"

Health and Community Services

Government of JERSEY

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[Recipient's name]
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[Postcode]

29 April 2020

Dear Islander

COVID-19 community antibody testing programme – we need you!

As part of the Government of Jersey's response to the COVID-19 crisis, you and all in your household have been selected to take part in our community antibody testing programme.

If you have already received a call from a member of our coronavirus helpline, you will have already been told the contents of this letter and booked an appointment. This letter does not change those arrangements. However, if you haven't already spoken to a member of the team, please read on to learn more and then call us on 01534 445566 to book an appointment.

Who's being tested and why
It is estimated that between 2% and 5% of the population have been exposed to coronavirus.

As one of 500 households who have been selected at random, we want to test you to see if you have already been exposed to COVID-19. We will then use all the results from this testing programme to create a snapshot of the Island. This picture will support our future decision making on how to safely exit the current 'Stay at Home' instruction.

About the test
The test is a finger-prick test, using a single drop of your blood, and your result will be ready ten minutes later.

We will tell you your result at the time of your visit and explain what it means. We will also record your result into a database, without any identifiable details such as your name or address, to send to Statistics Jersey to create an Island wide picture to be made publicly available.

Where we're testing
We have three testing centres, and your appointment will be at the centre nearest to your home. You will be given one appointment for everyone in your household to attend at the same time.

On arrival, you will be directed to a parking area and asked to stay in your car. Once the person who is carrying out your test is available, you will be asked to go into the centre. The testing team will not be able to keep two metres social distance from you so will be wearing personal protective equipment, such as a mask and gloves. Please let any children or older members of your household know in advance so as not to cause any concern.

At the start of your appointment, we will explain the process and you are welcome to ask any questions you might have. If you have any questions after your test, please phone the coronavirus helpline on 01534 445566.

This is a voluntary programme so you will not receive any payment for your involvement. By volunteering, you and everyone in your household is committing to being tested every four weeks and accepting that the information we gain through this testing programme will be used in future decision making to protect our community. We expect to finish testing in early autumn.

Accessing the test centre
We really need everyone who is selected and willing to participate in the testing programme to do so.

We would like you to come by car, if possible, so that different households are kept separate while waiting. If you do not have a car but wish to come to a test centre, please let us know and we will advise you of alternative waiting arrangements.

If you don't have access to a car, or are shielding yourself at home, we can arrange for your test to happen at home. A member of the team will call you ahead of their visit on the agreed date so that you know when to expect them.

What you need to do now
If you've already spoken to a member of the team, you need to take no action now. We look forward to seeing you on the day of your appointment at the agreed time.

If you haven't heard from a member of our team, please call the helpline on 01534 445566 to book an appointment.

Thank you for your participation in this testing and helping to create a snapshot of Jersey.

Yours faithfully

Deputy Richard Renouf
Minister for Health and Social Services

Information about your results

WE HAVE THE POWER

Thank you to everyone in your household for agreeing to take part in the community antibody testing programme.

In addition to the letter you should have now received, we would like to explain what your test results mean. Please see overleaf for your individual test result.

- 1,500 people from randomly selected households are taking part in this programme, from across the island. The results from this test group will give us a clear understanding of COVID-19 antibodies in our population.
- This testing programme will provide us with accurate information that can be used to support decision-making in relation to COVID-19, especially on how and when we can start to lift restrictions currently in place with Stay at Home.
- This test will be repeated every four weeks. A member of the Customer and Local Services team will phone you the week before the next round of testing to book your household appointment.
- These tests identify the presence of antibodies in blood. The tests are not sensitive enough to pick up antibodies in all cases and so are not used to diagnose people with COVID-19. The data will produce a general picture of antibodies in our population which is the key purpose of this testing programme.
- The COVID-19 IgG/IgM Rapid Test identifies whether the person is either positive or negative for antibodies Immunoglobulin M (IgM) and Immunoglobulin G (IgG).

Depending on your result you will be required to take the following action:

- **If C result, then negative. No further action**
- **If C + M (IgM) positive - Action required:** If you have not previously experienced any symptoms you will be booked an appointment for a PCR swab and should go into immediate isolation within your home, along with anyone else that you may live with while waiting for your result. If your PCR test returns a negative result, you can stop self-isolating, however your household must remain in isolation for 7 days. If you have previously experienced symptoms of COVID-19, which are now clear you do not need an appointment for a PCR swab, however you should go into immediate isolation within your home, along with anyone else that you may live with for a period of 14 days, back dated to the date you first experienced symptoms.
- **If G + M (IgM + IgG) - Action required:** You will be booked an appointment for a PCR swab and should go into immediate isolation within your home, along with anyone else that you may live with while waiting for your result. If your PCR test returns a negative result, you can stop self-isolating, however your household must remain in isolation for 7 days
- **If C + G (IgG) then positive to anti-body not contagious - No further action.** This result does not necessarily mean immunity.

If you have any questions regarding your results please contact the Coronavirus helpline on +44 (0)1534 445566.

Name: _____

Today my test result showed: _____

(–)

Negative

Only the control 'C' line appeared in the results window.

This means that the test has worked and indicates an absence of detectable anti-COVID-19 antibodies.

This means that you most likely have not been infected by COVID-19. You can get a negative result if you have come into contact with COVID-19 very recently, as there might not be enough antibodies in your blood to cause a positive result.

This test result does not mean you have immunity to COVID-19.

(+)

IgM

IgM positive is where a line shows for control 'C' line and detection line 'M'.

The novel coronavirus IgM antibody has been detected and the result is positive for the IgM antibody. This result suggests that you are currently contagious.

You must self-isolate and follow our current government guidelines. This test result does not mean you have immunity to COVID-19.

(+)

IgG and IgM

To be IgM and IgG positive both detection lines 'G' & 'M' have appeared along with the Control 'C' line.

This result means that the novel coronavirus IgG and IgM antibodies have been detected.

This result appears normally 7+ days after symptoms appear. This result could mean that you are contagious while your body is building up antibodies to the virus.

You must self-isolate and follow our current government guidelines. This test result does not mean you have immunity to COVID-19.

(+)

IgG

Control 'C' line and detection Line 'G' are present.

The novel coronavirus IgG antibody has been detected and the result is positive for the IgG antibody. This result indicates that you have been exposed to COVID-19 in the past but are not currently contagious.

This test result does not mean you have immunity to COVID-19.

Clinical sensitivity and specificity of three rapid SARS-CoV-2 Antibody (IgM/IgG) Tests on a hospitalized patient cohort: InTec, Cellex and OrientGene

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08-04-2020

1. Background

Serological detection of COVID-19 is key to see whether infection has already taken place however whether this also correlate with protection we still do not know. In addition to serological testing there is big urgency to have validated rapid diagnostic test (RDT) ready to be rolled out if found to be suitably sensitive and specific to test large populations quickly. It should be noted that there are limited data on whether immune responses will be the same in all patients independent of severity of illness.
There are countless RDTs developed/in development and offered to diagnostic laboratories. We have used the following criteria to consider inclusion of a RDT in our validation as the capacity of testing and clinical samples are limited:

1. A wide range of diagnostic tests are commercially available for SARS-CoV-2 (list collated by FIND - https://www.finddx.org/covid-19/pipeline/?section=immunoassays#diag_tab), some of which have received authorizations for use by various national regulatory agencies like CE marking or FDA approval. Checking whether the company had a product already prequalified in the WHO PQ scheme can ensure high QC in place.
2. Due to the pandemic situation high and continuous quantities should to be available within a short period eg a week.
3. Manufacturer should provide all paperwork for their validation studies.
4. Manufacturer should provide relevant details about the test details eg antigen used for a serological assay.
5. Specificity and sensitivity should be within an acceptable range; and it is important to check on which population the validation was done eg hospitalized patients, ambulant patients. Relevant controls should have been included eg healthy population and other infections with potential differential diagnosis and cross-reactive nature.
6. Right to share and publish data from validation/comparisons should be clarified.

We have selected InTec, Cellex and OrientGene tests as they fulfilled most criteria, and were available in big quantities enough to perform validation on a bigger sample set. InTec utilizes the N antigen, Cellex a combination of N and S; this information is not provided by OrientGene.

2. Purpose

This study was conducted at Erasmus MC viroscience, Rotterdam, NL between March 3, 2020 to analyze the clinical sensitivity and specificity of the following rapid tests:

1, *Rapid SARS-CoV-2 Antibody (IgM/IgG) Test* of InTec Product, Inc.

2, qSARS-CoV-2 IgG/IgM Cassette Rapid Test (GICA) of Cellex Inc.

3, COVID-19 IgG/IgM Rapid Test Cassette (Whole Blood/Serum/Plasma) Orient Gene / Healgen

3. Sample and reagent

- 93 serum samples from 24 PCR (1) confirmed COVID-19 patients at various time point post symptom onset.
- 1, kits of *Rapid SARS-CoV-2 Antibody (IgM/IgG) Test* of lot S2020021505. Expiry date: 14-08-2020
- 2, qSARS-CoV-2 IgG/IgM Cassette Rapid Test (GICA) of Cellex Inc. Test lot 20200311WI5513C-3. Expiry date: 3-9-2022
- 3, COVID-19 IgG/IgM Rapid Test Cassette (Whole Blood/Serum/Plasma) Orient Gene / Healgen. Test lot 2003260; Expiry date: 2022-03

Table 1. Sample panel used to validate the sensitivity and specificity of the antibody RDT for SARS-CoV-2

		Sensitivity		
Country	**Sample source**	**Infection**	**No. samples**	**post symptom onset range**
Netherlands	RT-PCR confirmed SARS-CoV-2	Mild/moderate	15	1-24
		Severe	78	1-43
		Specificity		
Netherlands	Healthy blood donors	NA	11	NA
Netherlands	Non-CoV respiratory infections*	Adeno virus	1	2-4weeks
		HMPV	3	2-4weeks
		Flu A	4	2-4weeks
		Flu B	4	2-4weeks
		RSV A	4	2-4weeks
		RSV B	4	2-4weeks
		CMV	2	2-4weeks
		EBV	3	2-4weeks
		Myco	1	2-4weeks
		Rhino virus	2	2-4weeks
Netherlands	hCoV infections	HCoV 229E	(6).	2-4weeks
		HCoV-NL63	(7).	2-4weeks
		HCoV-OC43	(9).	2-4weeks
		MERS	(3).	2-4weeks

* numbers were limited due to RDT kit availability

Equipment:

- Disposables including tips for the pipette
- Manual pipette
- Timer

Erasmus MC

4. Test principle

The tests were operated according to the test inserts. Samples were collected from COVID-19 suspected patients at Erasmus MC for diagnostic purpose and following PCR confirmation residual sera/plasma was used for this RDT evaluation. Patients were mostly moderate/seriously ill (15 ICU, 7 moderate, 2 mild).
Each sample was tested by one test and interpreted by two operators in parallel from Erasmus MC.

5. Test results and data analysis

Various samples showed (false)negative results with the tests compared to RT-PCR results (**Table 3, 4, 5**) and $PRNT_{50}$ neutralization (**Table 6**).

Possible reasons for the (false)negative results could be:

- The patients were at the very early infection stage, there was no antibody generated.
- Antibody concentration is below the limit of detection of the test.
- Neither IgG nor IgM to SARS-CoV-2 is present in the patient's sample that react with specific antigens utilized in the assay configuration.
- Extremely high concentrations of IgM and IgG which could have caused hook or prozone effect but it is unlikely in polyclonal responses.
- Unknown interference.

Table 3a Clinical sensitivity/specificity of the InTec test on SARS-CoV-2/other samples collected after 7 days from the symptom onset

		PCR		Total
		Positive	Negative	
Rapid SARS-CoV-2 Antibody (IgM/IgG) Test	Positive	67	17	84
	Negative	4	47	51
Total		71	64	135

The sensitivity on samples collected after 7 days from the symptom onset is 94.67% (95%CI: 86.90% to 98.53%) and the specificity is 79.01% (68.54% to 87.27%).

Table 3b Overall clinical sensitivity/specificity of InTec test on SARS-CoV-2/other samples

		PCR		Total
		Positive	Negative	
Rapid SARS-CoV-2 Antibody (IgM/IgG) Test	Positive	83	17	100
	Negative	10	47	57
Total		93	64	157

The sensitivity on all collected samples is 90.29% (95%CI:82.87% to 95.25%) and the specificity is 79.01% (68.54% to 87.27%).

Table 3c Overall clinical sensitivity/specificity of the IgG test on SARS-CoV-2/other samples

	1-7		**7- 14**		**>14**		
PCR	**IgG +**	**IgG -**	**IgG +**	**IgG -**	**IgG +**	**IgG -**	**Total**
	13	9	42	4	24	1	
Positive	22		46		25		93
Negative	Days since symptom onset not taken into account						
			IgG +	**IgG -**			
			9	55			
			64				64
							157

The sensitivity of IgG on all collected samples is 86.11% (95%CI: 78.13% - 92.01%%) and the specificity is 87.67% (77.88% -94.20%).

Table 3d Overall clinical sensitivity/specificity of the IgM test on SARS-CoV-2/other samples

	1-7		**7- 14**		**>14**		
PCR	**IgM +**	**IgM -**	**IgM +**	**IgM -**	**IgM +**	**IgM -**	**Total**
	12	10	40	6	20	5	
Positive	22		46		25		93
Negative	Days since symptom onset not taken into account						
			IgM +	**IgM -**			
			13	51			
			64				64
							157

The sensitivity of IgM on all collected samples is 81.58% (95%CI: 73.23% to 88.22%%) and the specificity is 83.12% (72.86% to 90.69%).

Erasmus MC

Table 4a Clinical sensitivity/specificity of the Cellex test on SARS-CoV-2/other samples collected after 7 days from the symptom onset

		PCR		Total
		Positive	Negative	
Rapid SARS-CoV-2 Antibody (IgM/IgG) Test	Positive	62	3	65
	Negative	9	41	50
Total		71	44	115

The sensitivity on samples collected after 7 days from the symptom onset is 88.75% (95%CI:79.72-94.72%) and the specificity is 93.62% (82.46% to 98.66%).

Table 4b Overall clinical sensitivity/specificity of the Cellex test on SARS-CoV-2/other samples

		PCR		Total
		Positive	Negative	
Rapid SARS-CoV-2 Antibody (IgM/IgG) Test	Positive	69	3	72
	Negative	24	41	65
Total		93	44	137

The sensitivity on all collected samples is 79.49% (95%CI:71.03% to 86.39%) and the specificity is 93.62% (82.46% to 98.66%).

Table 4c Overall clinical sensitivity/specificity of the IgG test on SARS-CoV-2/other samples

	1-7		**7- 14**		**>14**		
PCR	**IgG +**	**IgG -**	**IgG +**	**IgG -**	**IgG +**	**IgG -**	**Total**
	7	15	34	12	24	1	
Positive	22		46		25		93
Negative	Days since symptom onset not taken into account						
			IgG +	**IgG -**			
			2	42			
			44				44
							137

The sensitivity of IgG on all collected samples is 76.86% (95%CI: 68.32%-84.04%) and the specificity is 95.65% (85.16% to 99.47%).

Table 4d Overall clinical sensitivity/specificity of the IgM test on SARS-CoV-2/other samples

	0- 7		**7- 14**		**>14**		
PCR	**IgM +**	**IgM -**	**IgM +**	**IgM -**	**IgM +**	**IgM -**	**Total**
	7	15	38	8	24	1	
Positive	22		46		25		93
Negative	Days since symptom onset not taken into account						
			IgM +	**IgM -**			
			3	41			
			44				44
							137

The sensitivity of IgM on all collected samples is 79.49% (95%CI: 71.03% to 86.39%) and the specificity is 93.62% (82.46% to 98.66%.)

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Table 5a Clinical sensitivity/specificity of the OrientGene test on SARS-CoV-2/other samples collected after 7 days from the symptom onset

		PCR		Total
		Positive	Negative	
Rapid SARS-CoV-2 Antibody (IgM/IgG) Test	Positive	60	0	60
	Negative	9	9	18
Total		69	9	78

The sensitivity on samples collected after 7 days from the symptom onset is 88.46% (79.22%-94.59%) and the specificity is 100% (66.37%-100%) however specificity is based on too few samples due to limited access to tests.

Table 5b Overall clinical sensitivity/specificity of the OrientGene test on SARS-CoV-2/other samples

		PCR		Total
		Positive	Negative	
Rapid SARS-CoV-2 Antibody (IgM/IgG) Test	Positive	72	0	72
	Negative	18	9	27
Total		90	9	99

The sensitivity on all collected samples is 83.33% (74.94% - 89.81%) and the specificity is 100% (66.37%-100%) however specificity is based on too few samples due to limited access to tests.

5c Overall clinical sensitivity/specificity of the IgG test on SARS-CoV-2/other samples

	1-7		**7- 14**		**>14**		
PCR	**IgG +**	**IgG -**	**IgG +**	**IgG -**	**IgG +**	**IgG -**	**Total**
	10	11	32	12	25	0	
Positive	21		44		25		90
Negative	Days since symptom onset not taken into account						
			IgG +	**IgG -**			
			0	9			
			9				9
							99

The sensitivity of IgG on all collected samples is 79.65% (95%CI: 71.04% -86.64%), specificity is 100% (66.37% -100%).

Table 5d Overall clinical sensitivity/specificity of the IgM test on SARS-CoV-2/other samples

	1-7		**7- 14**		**>14**		
PCR	**IgM +**	**IgM -**	**IgM +**	**IgM -**	**IgM +**	**IgM -**	**Total**
	12	9	34	10	18	7	
Positive	21		44		25		90
Negative	Days since symptom onset not taken into account						
			IgM +	**IgM -**			
			0	9			
			9				9
							99

The sensitivity of IgM on all collected samples is 77.59% (68.91% to 84.81%), 100.00% (66.37%- 100%).

7. Correlation with neutralization

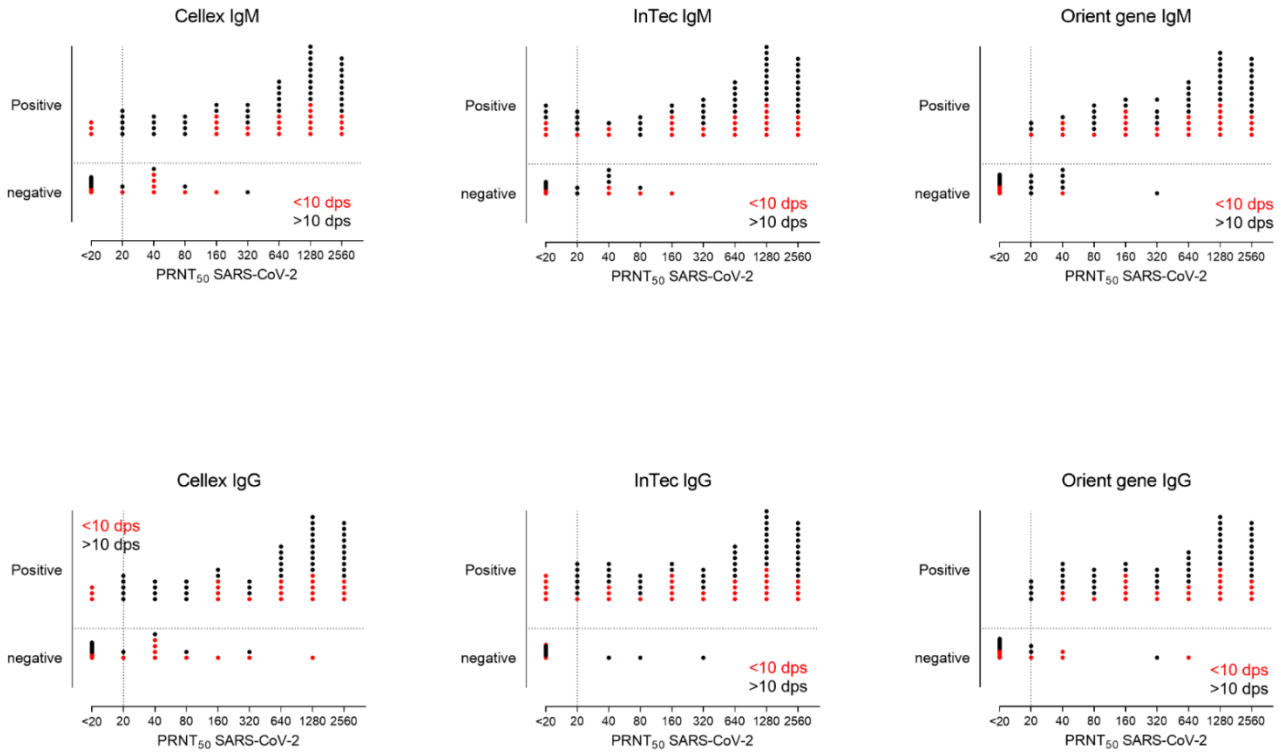

Table 6. Sensitivity and specificity of the three tested RDTs (CI 95%) compared to $PRNT_{50}$ results, whole sample set and samples >10 days post symptom onset (borderline $PRNT_{50}$ values counted as positive).

	Cellex		InTec		Orient gene	
	IgM	**IgG**	**IgM**	**IgG**	**IgM**	**IgG**
Sensitivity-overall	**87.36%** (78.50% to 93.52%)	**84.44%** (75.28% to 91.23%)	**88.37%** (79.65% to 94.28%)	**95.00%** (87.69% to 98.62%)	**89.41%** (80.85% to 95.04%)	**91.57%** (83.39% to 96.54%)
Sensitivity >10 DPO	**98.08%** (89.74% to 99.95%)	**96.23%** (87.02% to 99.54%)	**91.07%** (80.38% to 97.04%)	**98.08%** (89.74% to 99.95%)	**86.44%** (75.02% to 93.96%)	**94.44%** (84.61% to 98.84%)
Specificity - overall	**80.95%** (58.09% to 94.55%)	**85.00%** (62.11% to 96.79%)	**73.91%** (51.59% to 89.77%)	**77.27%** (54.63% to 92.18%)	**100.00%** (80.49% to 100.00%)	**100.00%** (80.49% to 100.00%)

8. Conclusion

According to the test results of the 93 samples from PCR confirmed COVID-19 patients, the sensitivity/specificity of the tests are:

- **InTec *Rapid SARS-CoV-2 Antibody (IgM/IgG) Test*** has an overall sensitivity of 90.29% (95% CI: 82.87% to 95.25%) and specificity of 79.01% (68.54% to 87.27%). The sensitivity on samples collected after 7 days from the symptom on set is 94.67% (95%CI:86.90% to 98.53%), specificity is 79.01% (68.54% to 87.27%).
- **Cellex qSARS-CoV-2 IgG/IgM Cassette Rapid Test (GICA)** has an overall sensitivity of 79.49% (95%CI:71.03% to 86.39%) and specificity of 93.62% (82.46% to 98.66%). The sensitivity on samples collected after 7 days from the symptom on set is 88.75% (95%CI:79.72-94.72%), specificity is 93.62% (82.46% to 98.66%).
- **Orient Gene/Healgen COVID-19 IgG/IgM Rapid Test Cassette** has an overall sensitivity of 83.33% (74.94% to 89.81%) and specificity of 100.00% (66.37%-100%). The sensitivity on samples collected after 7 days from the symptom on set is 88.46% (79.22% to 94.59%), specificity is 100% (66.37%-100.00%).

Compared to RT-PCR, InTec product showed the highest overall sensitivity followed by OrientGene and Cellex. Samples >7 days post symptom onset were detected more often.

Caveat of the specificity owing to limited availability of test kits, the validation was limited on this point. However based on observations above we would recommend further testing on all three tests.
For neutralization, samples taken >10 days post onset correlate well with neutralization activity with all tests.
Evaluation should also be carried out with samples from asymptomatic/mild population.

9. References

1, https://eurosurveillance.org/content/10.2807/1560-7917.ES.2020.25.3.2000045

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