Sensitivity of red blood cell antibody screening tests
-
The 2024 EQALM Super Challenge

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Austrian Association for Quality Assurance and Standardization
of Medical and Diagnostic Tests (ÖQUASTA)

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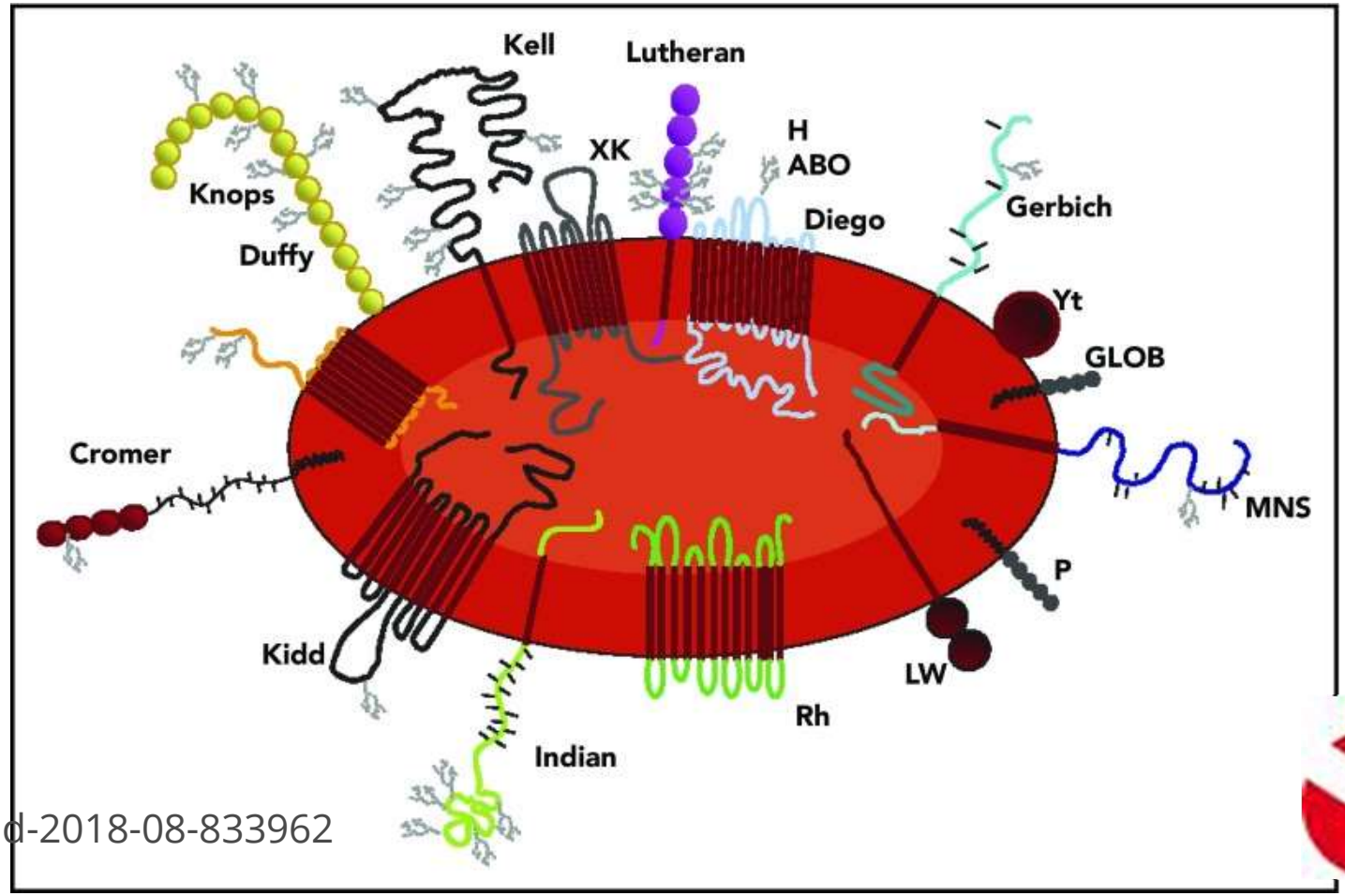
Background -
Antigens on red blood cells



DOI: 10.1182/blood-2018-08-833962

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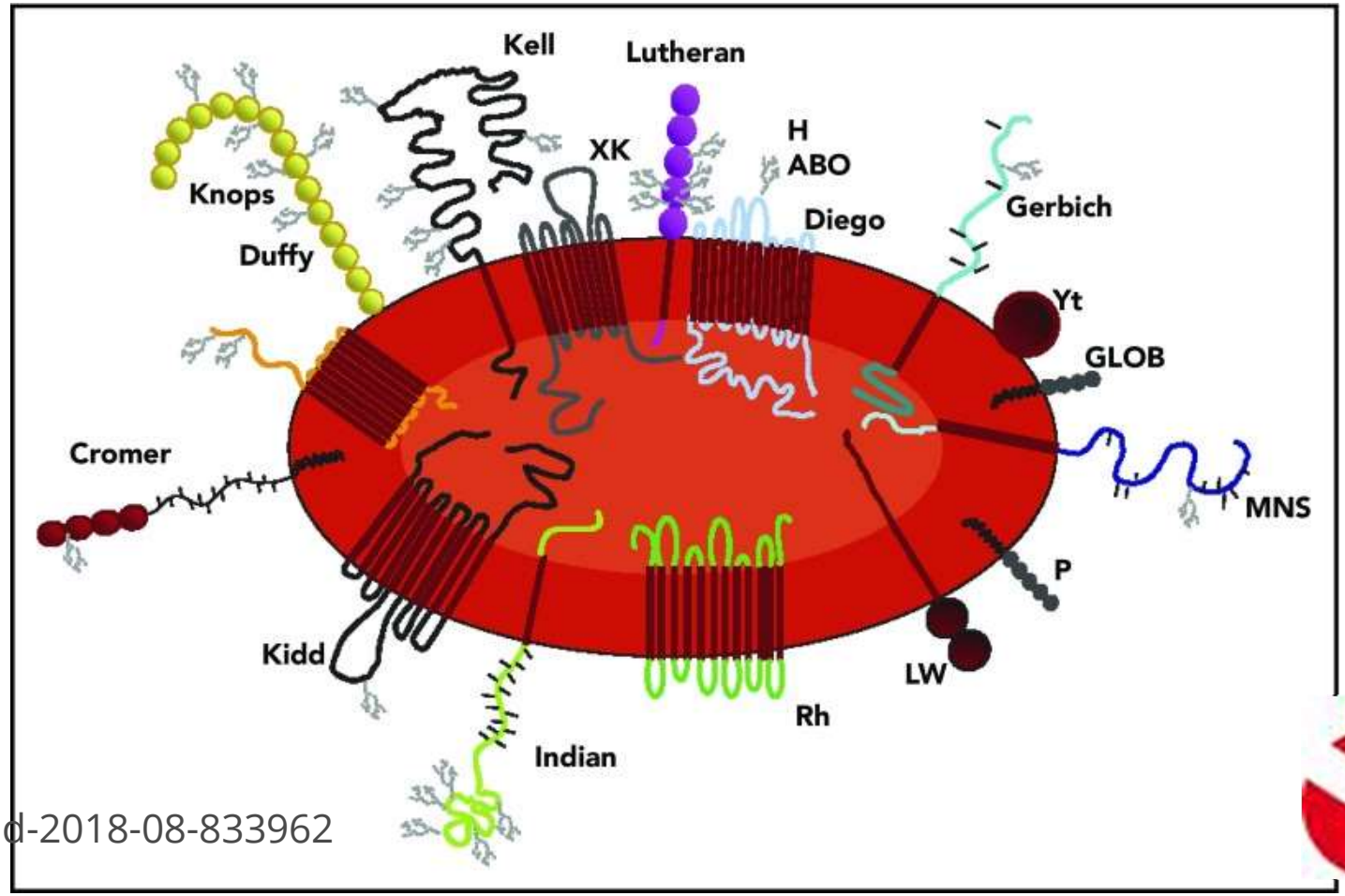
Background -
Antigens on red blood cells = Blood groups



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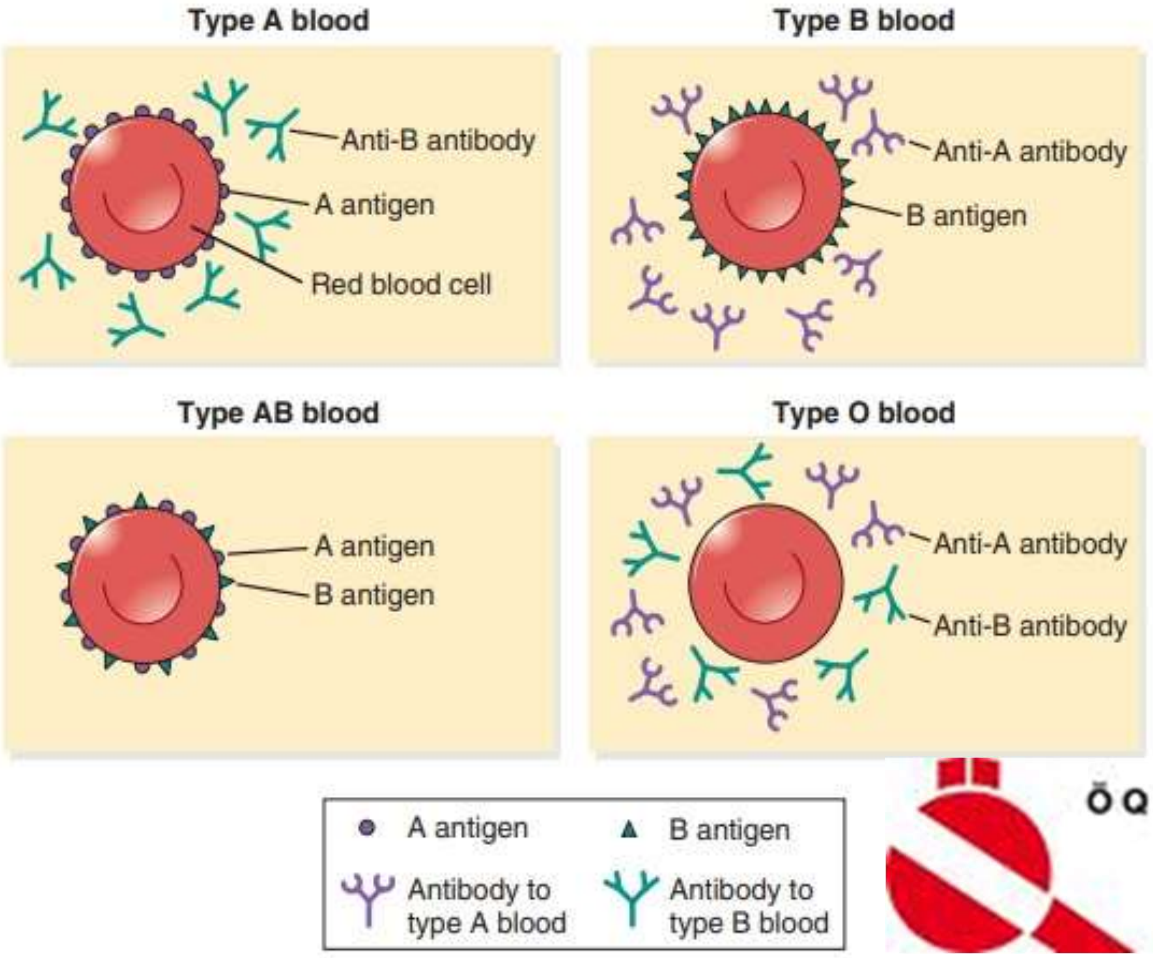
Background -
Antibodies against antigens on red blood cells

Anti-A and Anti-B are „regular“ antibodies, as they are present in all individuals complementary to their ABO blood group.



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Background -
Antibodies against antigens on red blood cells

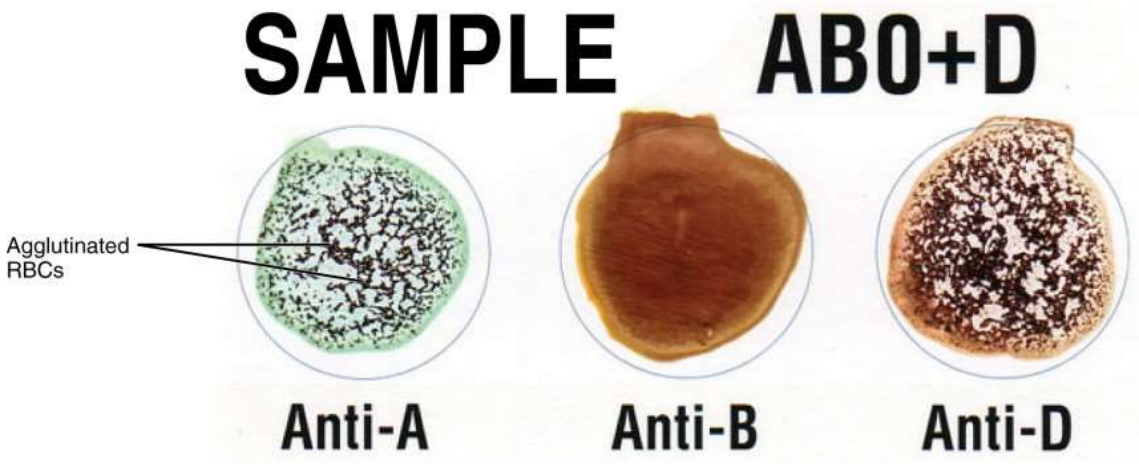
Antibodies against antigens of all other blood group systems are „irregular“ antibodies.

Most common: Rhesus (D, E, e, C, c)
Kell
Kidd
Duffy

Background -
Relevance of antibodies against antigens on red blood cells

Reaction of antibodies with their corresponding antigen causes

- Agglutination of RBC (*in vitro* - diagnostic purposes)



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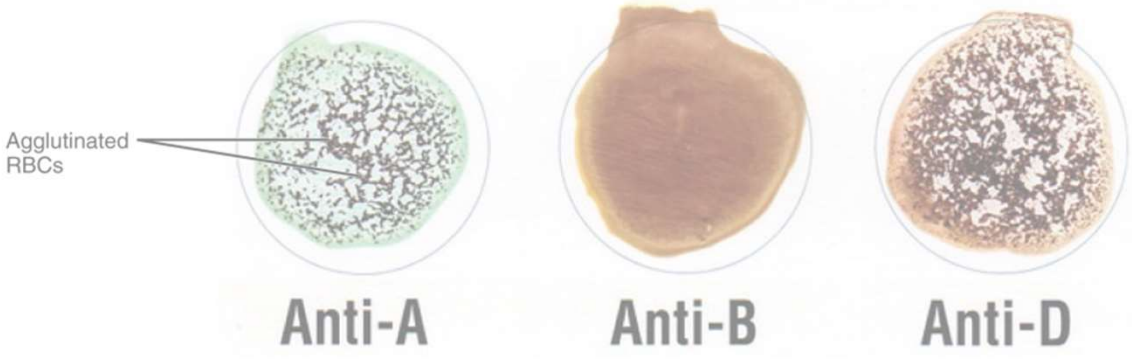
Background -
Relevance of antibodies against antigens on red blood cells

Reaction of antibodies with their corresponding antigen causes

- Agglutination of RBC (*in vitro* - diagnostic purposes)
- Haemolysis (*in vivo*)



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Background -
Screening for presence of irregular RBC antibodies

Presence of specific irregular RBC antibodies is a sign of immunization against an antigen.

Upon reactivation of B-lymphocytes (“memory B cells“), they proliferate and differentiate into antibody-secreting plasma cells.

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Background -
Screening for presence of irregular RBC antibodies

The immunological spectacle begins and quickly leads to an increase in the concentration of specific antibodies that cause haemolysis.

Newly formed antibodies are primarily responsible for haemolytic transfusion reactions; antibodies already present before the new contact with the antigen make a rather minor contribution.

Background -
Screening for presence of irregular RBC antibodies

High sensitivity of antibody screening tests is required to identify as many carriers of irregular antibodies as possible.

Several publications on specificity of RBC antibody screening tests, but none on their sensitivity.
No information provided by manufacturers.

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Study plan

- Pilot study
- 3rd WHO International Standard Anti-D Immunoglobilin
- samples with low concentrations of Anti-D

  0.1 - 0.025 - 0.01 - 0.005 IU/mL
- Verification of concentrations by microtitration at the French National Reference Center in Perinatal Hemobiology
- Preparation of samples by Antitoxin, Bammental, Germany

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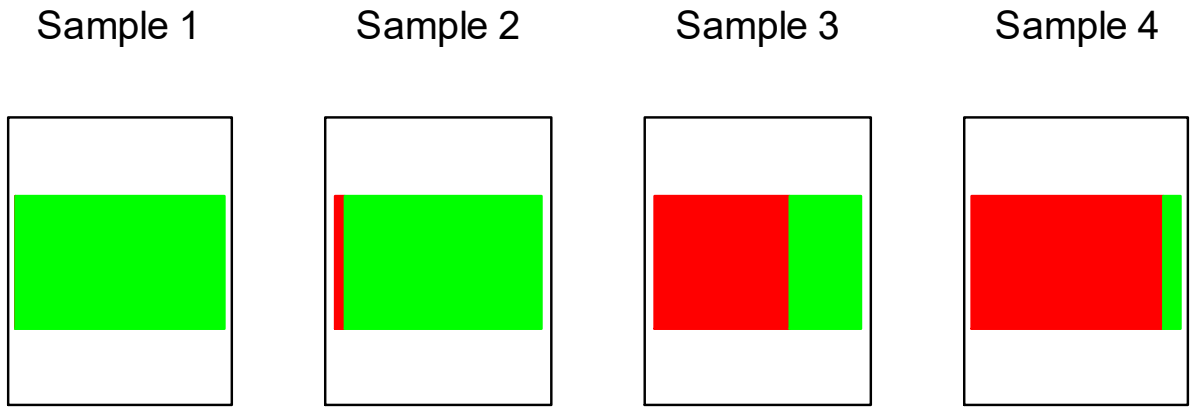
(preliminary) Results
Numbers and percentage of positive results (=antibodies detected)



Concentr. Anti-D	0.1 IU/mL	0.025 IU/mL	0.01 IU/mL	0.005 IU/mL
positive	**99.5%** 1633	**95.0%** 997	**34.5%** 350	**8.5%** 127
negative	9	52	665	1374
N =	1642	1049	1015	1501

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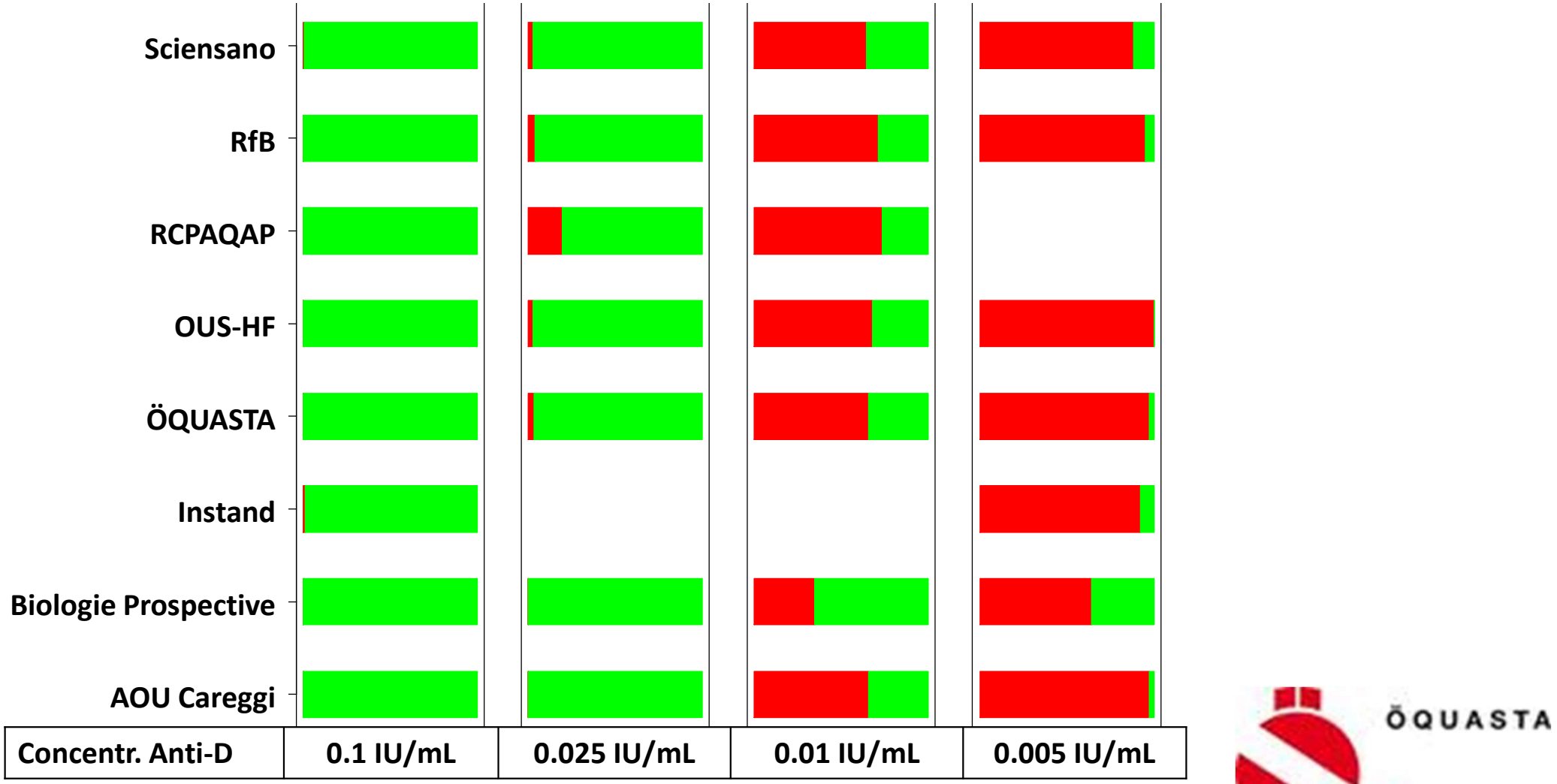
Results - Anti-D detection rates per EQA provider



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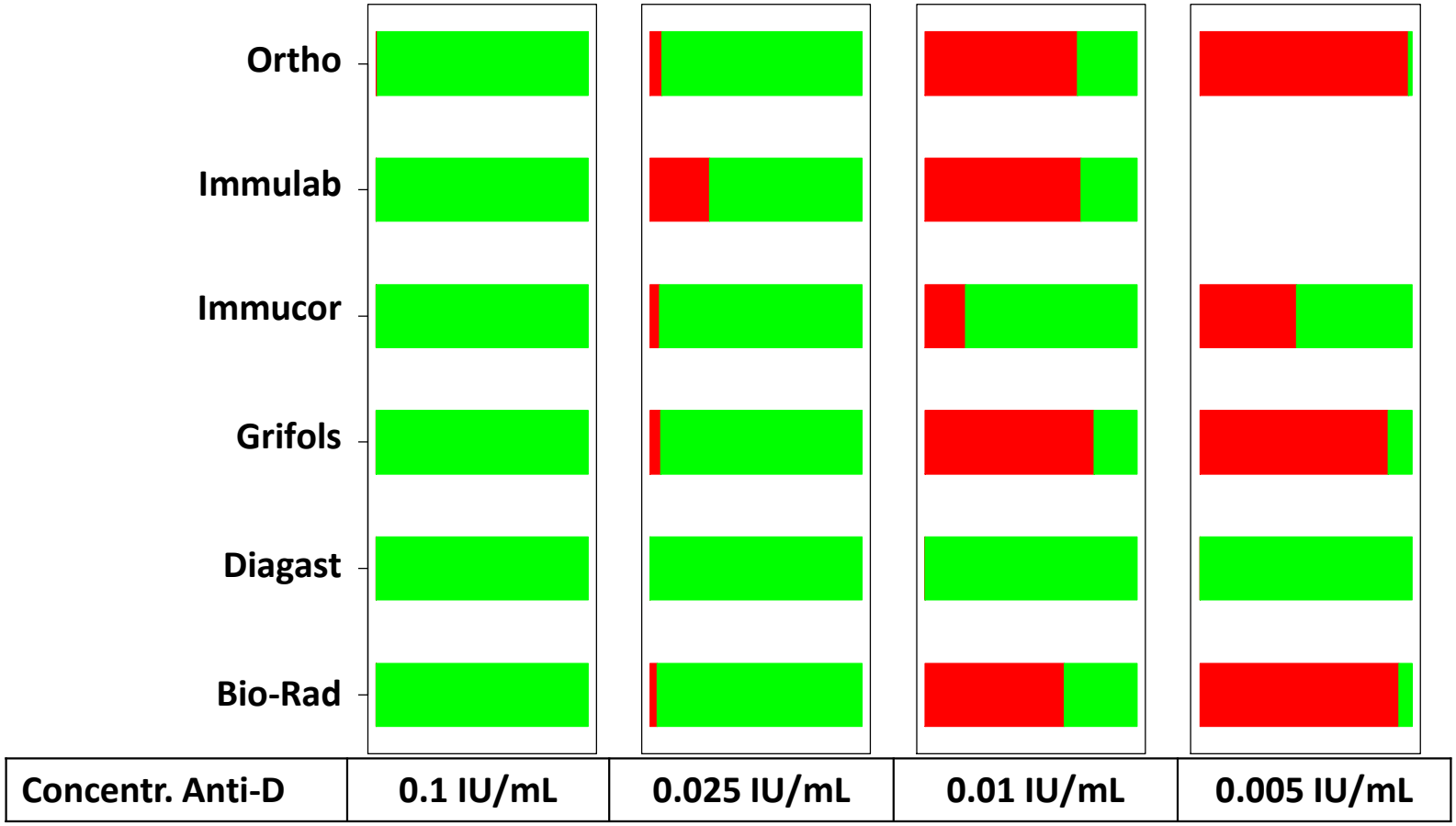
Results - Anti-D detection rates per manufacturer



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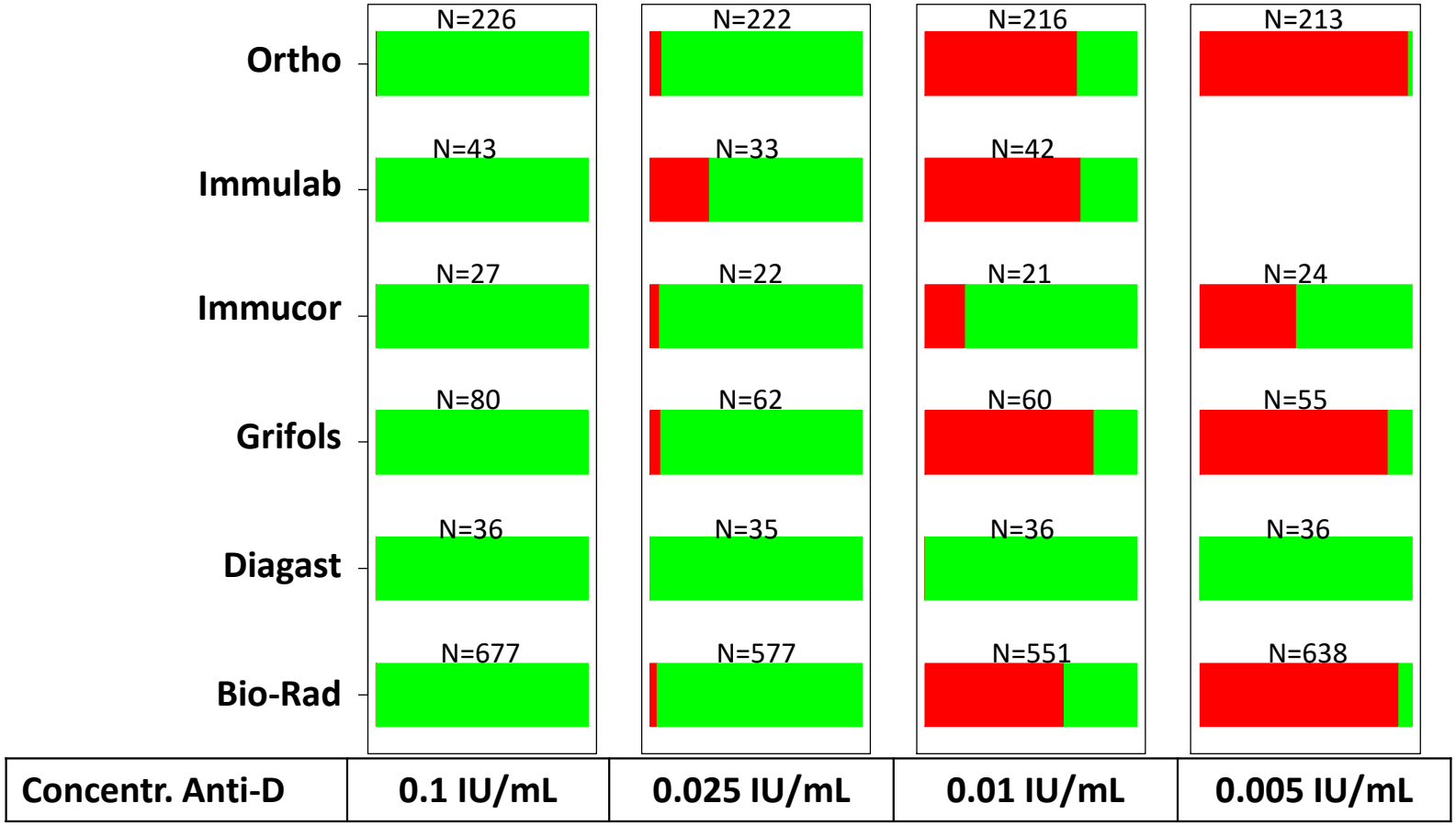
Results - Anti-D detection rates per manufacturer



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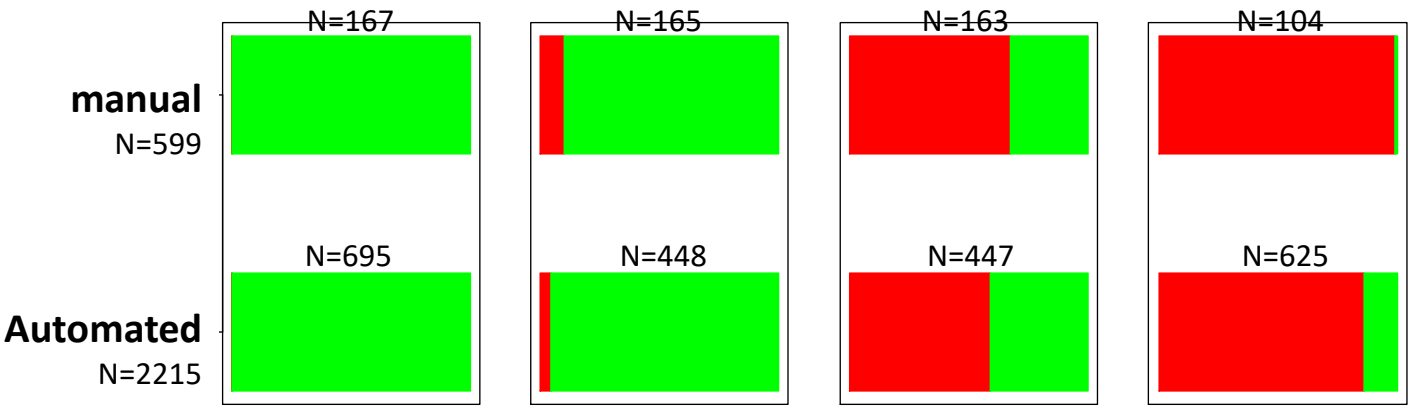
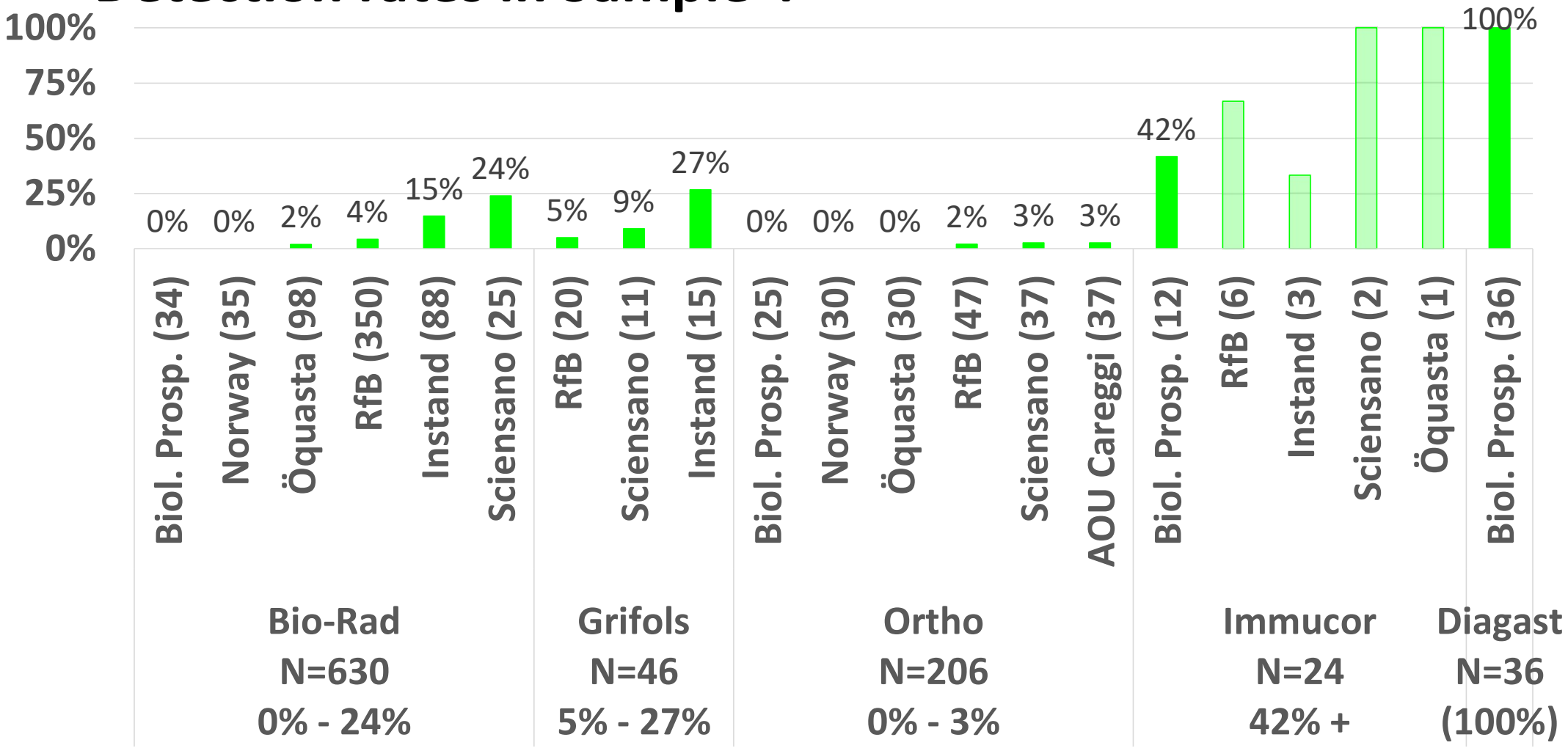
Results
Anti-D detection rate automated vs. manual reading



Concentr. Anti-D	0.1 IU/mL	0.025 IU/mL	0.01 IU/mL	0.005 IU/mL

Results
Detection rates in Sample 4



Next steps

- ☞ complete data collection
- ☞ repeat evaluation
- ☞ evaluate impact of methods (gel, microcolumn, tube)
- ☞ evaluate performance of different batches of reagents and test cells

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Take home messages

- Screening for irregular RBC antibodies is a surrogate test for immunization by RBC antigens
- Repeated contact with an antigen may cause delayed haemolytic reactions (on the occasion of transfusion or pregnancy)

Take home messages

- High sensitivity of antibody screening tests is required to ensure a low rate of undetected immunized individuals
- Antibody screening tests have different limits of detection
- Stay tuned for the final results!

Take home messages

- High sensitivity of antibody screening tests is required to ensure a low rate of undetected immunized individuals
- Antibody screening tests have different limits of detection
- Stay tuned for the final results!
- **Please participate in concerted EQA challenges!**

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Thank you for your attention!