A five-year review of the RCPAQAP Antigen Phenotyping EQA

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Introduction

It is vital for Transfusion laboratories to correctly identify red cell phenotypes in patient samples and donor units to ensure compatible red cells are provided to patients with clinically significant antibodies and prevent alloimmunisation.

The RCPAQAP offers an Antigen Phenotyping module (AP) as a part of their General Transfusion programs.

Participating Transfusion laboratories perform red cell phenotyping to confirm the presence or absence of a range of red cell antigens.

We sought to do a retrospective assessment of how well participants performed phenotyping on red blood cells using serological methods over a five-year period.

Materials and methods

A total of 20 whole blood samples (4 per year per site) containing a red cell preservative (Celpresol™) were provided to an average of 204 laboratories enrolled for the AP program over a five-year period (2017–2021).

The enrolled participants were asked to perform phenotyping for a range of the red cell antigens; C, c, E, e, K, k, Kpa, Kp^b, Fy^a, Fy^b, Jk^a, Jk^b, M, N, S, s, P1, Le^a, Le^b, Lu^a, Lu^b, C^w.

The returned results were analysed using RCPAQAP in-house statistical software and the overall error rates along with specific phenotype errors assessed over time.

Results and Discussion

The overall error rate varied from 0.95% in 2017 to 0.57% in 2020 (Table 1).

There was also an increasing number of participants testing for a broader range of red cell antigens based on the number of returned results (Table 1).

An error rate greater than or equal to 2.0% is considered a high error rate by the RCPAQAP Transfusion. Table 2 shows the list of antigens with high error rates over the five years, noting that the high error rates were mostly seen in antigens that are tested infrequently, and not every participating laboratory is equipped to perform extended red cell phenotyping

The number of antigens with high error rates has been progressively decreasing, which is an indication that the participants are correctly performing red cell antigen phenotyping, as well as continuously working on improving their testing methods (Table 2).

Although, the ABO/Rh typing is routinely performed on patients requiring blood transfusions, an extended antigen phenotyping may also need to be performed[1].

When a patient with potentially clinically significant antibodies needs a blood transfusion, red blood cell units should be tested and found negative for the corresponding antigen(s)[1].

This is potentially critical to avoid a haemolytic transfusion reaction, and / or the formation of new alloantibodies.

Table 1. Number of participant responses who have conducted red cell phenotyping and the percentage of laboratories that have failed to identify the correct targets.

Year	Total Submitted (n)	Total Errors (n)	% Errors
2017	11760	112	0.95%
2018	12041	98	0.81%
2019	12823	96	0.75%
2020	13200	75	0.57%
2021	13585	91	0.67%

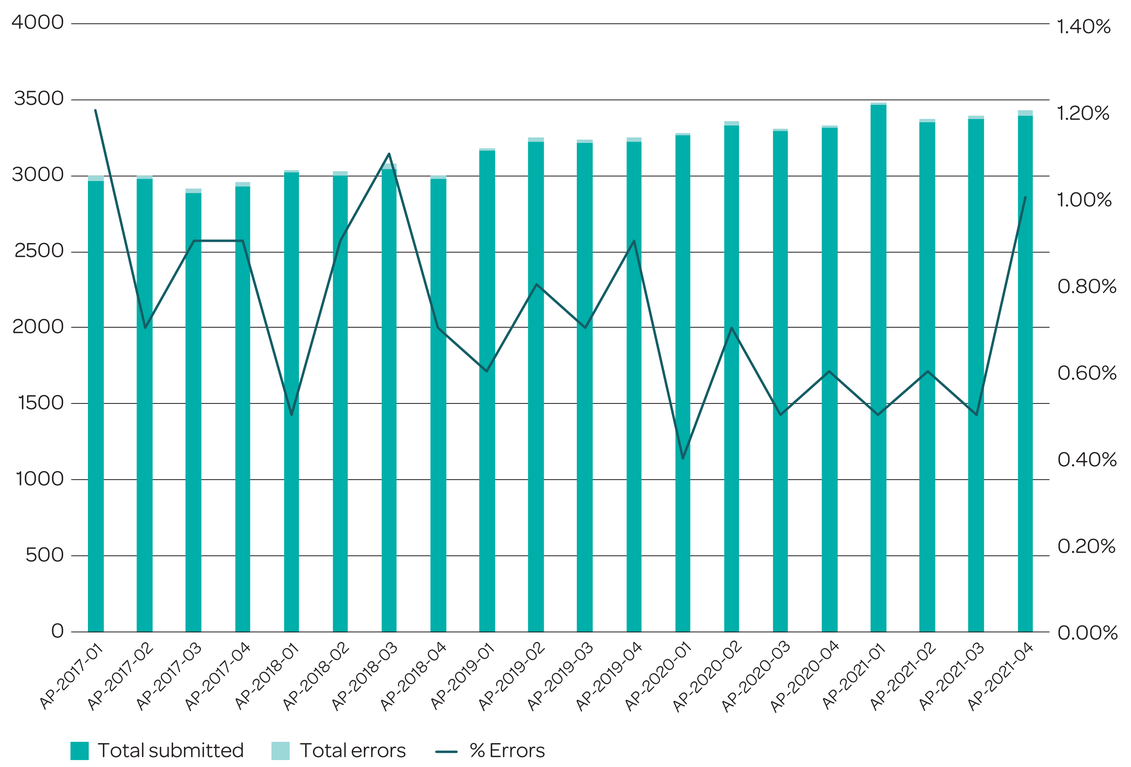

Figure 1. Red Cell Phenotyping Summary of Performance from 2017–2021

Table 2. List of antigens with high error rates (error rate ≥2.0%).

Survey round	Antigens with high error rates
AP2017-01	k (2.1%), Jk^a (2.4%), M (4.3%), Le^b (2.4%)
AP2017-02	k (2.2%), Fy^b (2.4%), N (2.1%), Le^b (3.2%), Lu^b (4.2%)
AP2017-03	Jk^b (3.1%), N (2.2%), s (2.1%), P1 (5.9%), Le^a (2.5%), Lu^b (3.8%)
AP2017-04	k (3.3%), Kp^b (4.2%), Fy^b (2.4%), N (3.0%)
AP2018-01	N (4.2%) and Lu^a (2.1%)
AP2018-02	P1 (5.6%) and Lu^a (2.1%)
AP2018-03	Le^a (10.2%), P1 (4.3%), N (2.7%), Le^b (2.4%)
AP2018-04	k (2.0%) and N (3.4%)
AP2019-01	P1 (10%), Lu^a (2.0%), Lu^b (3.4%)
AP2019-02	N (2.6%), P1 (3.7%), Le^b (2.3%), Lu^a (2.0%)
AP2019-03	Kp^b (3.2%) and Jk^a (3.3%)
AP2019-04	Jk^b (2.2%), N (3.9%), S (2.3%), Le^a (2.3%), Le^b (3.1%)
AP2020-01	N (2.5%) and Lua (4.1%)
AP2020-02	N (8.6%)
AP2020-03	Kp^b (3.0%)
AP2020-04	P1 (3.4%)
AP2021-01	Le^b (2.9%)
AP2021-02	Jk^a (3.7%)
AP2021-03	N (3.6%)
AP2021-04	N (7.2%)

Conclusion

The increasing number of participants testing for a broader range of red cell antigens and the reduction in associated error rates since 2017 demonstrate the importance of this type of external quality assurance program.

Participants are reminded to follow the manufacturer's instructions[2] and use appropriate negative and weak-positive controls (e.g. from heterozygous donors) during phenotyping[1].

References:

1. Roback J, Grossman B et al. AABB Technical Manual (17th Ed). (2011).
2. 1. ANZSBT Guidelines for Transfusion and Immunohaematology Laboratory Practice 1st Edition, Revised January 2020, section 8.6.1.1.

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