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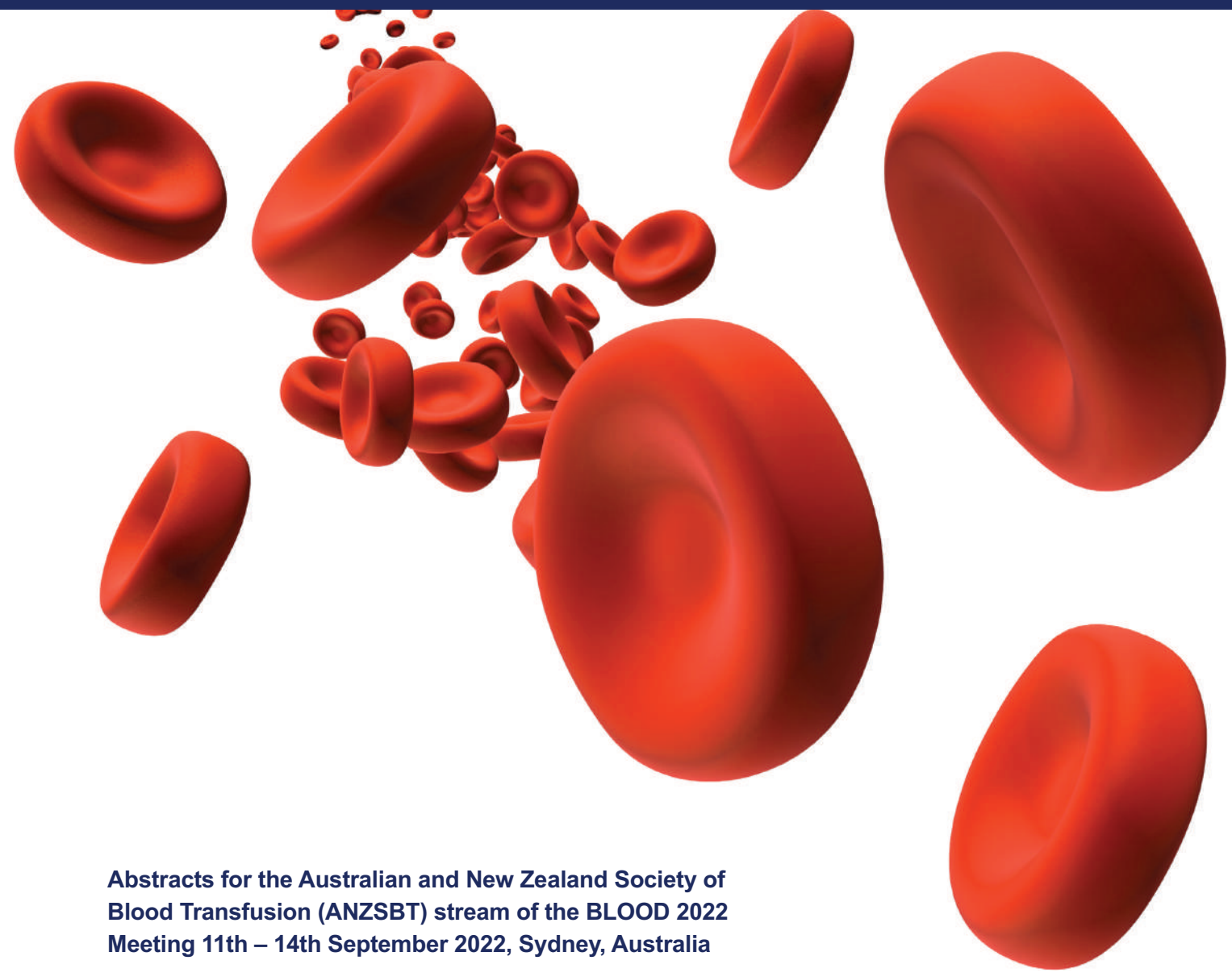

Abstracts for the Australian and New Zealand Society of Blood Transfusion (ANZSBT) stream of the BLOOD 2022 Meeting 11th – 14th September 2022, Sydney, Australia

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Abstracts for the Australian and New Zealand Society of Blood Transfusion (ANZSBT) stream of the BLOOD 2022 Meeting
11th – 14th September 2022,
Sydney, Australia

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ABSTRACT

TRANSFUSION MEDICINE WILEY

Abstracts for the Australian and New Zealand Society of Blood Transfusion (ANZSBT) stream of the BLOOD 2022 Meeting 11th – 14th September 2022, Sydney, Australia

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Presidential Symposium Award

Blood donor, component and recipient-specific factors associated with venous thromboembolism in transfused hospitalized adult patients: Data from the recipient epidemiology and donor evaluation study-III (REDS-III)

Dr Ruchika Goel[1], Dr Colleen Plimier[2], Dr Nareg Roubinian[2]
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Objective: Growing evidence suggests multiple pathophysiological mechanisms linking RBC transfusions to thrombotic outcomes. This study aims to assess various donor, blood component, and recipient-specific factors, which may be associated with thromboembolic outcomes following RBC transfusions.

Methods: Recipient Epidemiology Donor Evaluation Study-III (REDS-III) database on patients transfused in 12 academic hospitals across different geographic regions of the United States between 2013 and 2016 was used. Linkage analysis of associations of donor and component modification characteristics on the outcomes of patients transfused RBC units were performed using stratified Cox proportional hazards regression models with time-dependent exposures.

Results: 59603 patients were transfused 229 500 RBC units during the course of 79 298 hospitalizations with VTE occurring in 1869 (2.4%) of patients. In adjusted regression analyses, female donor sex, storage duration greater than 5 weeks, gamma irradiation, AS-1 storage solution, and apheresis-derived collections were associated with VTE. Among recipient factors, pre-transfusion anemia, obesity, and primary diagnoses including malignancy, cardiovascular risk factors, and sepsis were associated with VTE in adjusted regression analyses. ($p < 0.01$ for all associations). The dose-dependent association of the donor and component factors on VTE was modest in contrast to those of recipient-specific risk factors.

Discussion: We identify several donor, component, and recipient-specific factors associated with VTE in transfused hospitalized adult patients. Studies identifying mechanistic pathways linking these factors with thrombotic outcomes are needed. Identifying some of the modifiable variables can be critically important in future precision transfusion medicine-based decisions in accounting for donor and component modifications specific variation in choosing the optimal units for transfusion.

ANZSBT Presidential Symposium Presentations

Young Investigator Award (Sponsored by the National Blood Authority)

Predicting the severity of cardiac iron-overload in transfusion dependent thalassemia (TDT) patients through deep learning

Mrs Yusra Shahid[1], Mrs Sadaf Iqbal Behlim[1], Dr Zahra Hoodbhoy[2], Dr Babar Hasan[2], Dr Fateh Ali Tipoo Sultan[2]
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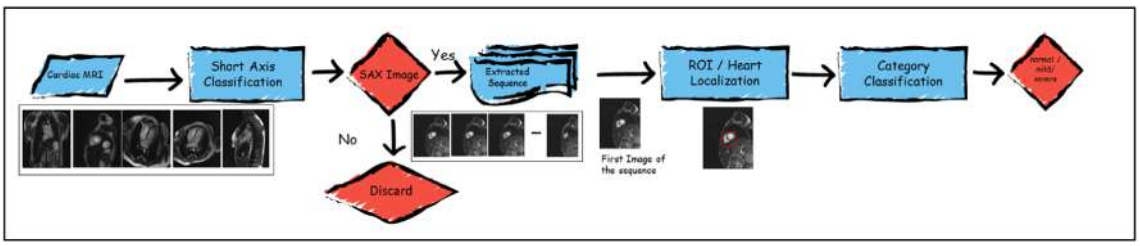
Aim: Cardiac iron overload is among the leading causes of morbidity and mortality in TDT. The detection of cardiac iron overload requires Cardiac Magnetic Resonance Imaging (CMR) along with an expensive software and a highly trained interpreter. The objective of this study is to develop a deep learning algorithm on CMR images to identify myocardial iron overload in TDT patients, thus bypassing the need for a costly specialized software and highly trained professionals.

Method: For this study, the CMR data of 661 TDT patients (from May 2014 – June 2019) was provided by Aga Khan University Hospital, Karachi, Pakistan. The images included apical 2-chamber view, apical 4-chamber view, left and right ventricular view, and short axis view of the heart. The short axis view was the image of interest, which was used to calculate the severity of iron overload.

After extracting short axis sequences from the CMR images through classification model, we localized the heart from the first image only and treated it as the Region of Interest (ROI) contrary to the conventional manual delineation of septum which is time consuming and prone to error. This ROI was given as input to Convolutional Neural Network (CNN) for predicting the severity of iron overload (normal, mild/moderate and severe). Since the category classification model uses ROI from the first image only, therefore, this technique can be easily used for free breathing short axis images. The dataset was divided into 80% training, 10% validation and 10% testing sets. The model was evaluated based on accuracy, precision, recall, and f1 score for all three classes.

Results: The severity of distribution of data for the 3 target classes was 39% normal, 19% mild, and 42% severe. With our algorithm, for all three classes on average we were able to achieve; 90% accuracy with precision, recall and f1 score being 0.89, 0.90 and 0.88 respectively.



Conclusion: Management based on accurate estimation of iron overload using CMR has improved the survival of TDT patients. However, in resource-limited settings, access to interpretation of CMR is limited. This study reports that a deep learning algorithm was able to identify the category with >85% accuracy without the need of software or trained personnel. If implemented, this algorithm has the potential to improve health outcomes in TDT patients in a resource efficient manner.

Best Poster or Oral Presentation on Patient Blood Management (Sponsored by the National Blood Authority)

Making decisions about platelet transfusions in patients with myelodysplastic syndromes (MDS): A clinician survey to inform future clinical trials

Dr Allison Mo[1,2,3,4], Dr Robert Weinkove[4,5,6], Prof Jake Shortt[2,4,7], Dr Anna Johnston[4,8], Prof Erica Wood[1,2,4], Assoc Prof Zoe McQuilten[1,2,4], ALLG Supportive Care Working Party[4]

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Aim: Thrombocytopenia and bleeding are common in MDS but optimal management and current practice, including prophylactic platelet transfusions (PLT) or tranexamic acid (TXA) use, is unclear. We conducted a survey aiming to describe current use of PLT and TXA to inform future trial design on management of MDS-related thrombocytopenia.

Method: Following ethics approval, a 25-question survey was developed and piloted within the ALLG Supportive Care group, then distributed to all 436 ALLG members in December 2020 and July 2021.

Results: 64 clinicians across Australia, New Zealand and Singapore responded (response rate 15%); including 60 (94%) specialists, 2 (3%) registrars, 2 (3%) nurses. Clinicians treated a median of 15 MDS patients annually, including median 5 patients receiving disease-modifying therapies and median 2 with thrombocytopenic bleeding.

Guidelines Institutional guidelines for PLT and PLT thresholds varied (Table 1). Only 45% of respondents reported guidelines for prophylactic PLT, and 10% for TXA prophylaxis.

Clinical practice A median of 80% of patients did not need regular treatment for thrombocytopenia; 5% received prophylactic PLT, 5% regular TXA, 0% received both TXA and prophylactic PLT. Three scenarios involving MDS patients with thrombocytopenia were presented (Table 2); respondents were more likely to give prophylactic PLT during disease-modifying therapy (e.g., azacitidine) (76%, commonest platelet threshold $<10 \times 10^9$/L) or to patients with minor bleeding (50% transfusing at platelet threshold $<20 \times 10^9$/L; 35% at platelet threshold $<10 \times 10^9$/L). For stable patients not on treatment, responses varied; 45% would not give PLT and 50% would give PLT.

Clinical trials 72% were interested in recruiting patients to trials in this area. Potential barriers included resource limitations, funding, patient, and clinician acceptance.

Conclusion: This survey suggests marked variability in the management of MDS-related thrombocytopenia management, and a need for clinical trials to inform practice.

Does your institution have guidelines for:	Yes n(%)	PLT threshold if yes (x10^9/L)				
		<10	<20	<30	<50	Other
Prophylactic PLT in stable MDS patients	29 (45%)	24/29 (83%)	1/29 (3%)	0	0	4/29 (13%)
Therapeutic PLT in bleeding MDS patients	36 (56%)	0	16/36 (44%)	5/36 (14%)	7/36 (19%)	8/36 (22%)
Prophylactic PLT prior to bone marrow biopsy	13 (20%)	2/13 (15%)	4/13 (30%)	3/13 (23%)	1/13 (7%)	3/13 (23%)
Prophylactic PLT prior to Hickman/PICC line	41 (64%)	1/41 (2%)	5/41 (12%)	6/41 (15%)	26/41 (63%)	3/41 (7%)

Table 1: Institutional guidelines

Scenario	PLT threshold (x10^9/L) for prophylactic transfusion					
	<5	<10	<20	<50	Would not give PLT	Other
Stable patient, not on disease-modifying therapy, no history of bleeding	6(9%)	25(39%)	1(2%)	0	29(45%)	2(3%)
Stable patient, on azacitidine, no history of bleeding.	4(6%)	45(70%)	0	0	6(9%)	1(2%)
Minor bleeding already taking TXA	1(2%)	22(34%)	32(50%)	3(5%)	3(5%)	3(5%)

Table 2: Clinical scenarios

ANZSBT Member's Award

Assembling a reference *RHD* gene to personalise transfusion management for the Indigenous Australian population

Ms Mia Sarri[1], Ms Candice Davison[1], Dr Eunike McGowan[1], Dr Genghis Lopez[1,2], Ms Glenda Millard[1], Ms Maree Perry[1], Ms Aiobhe Mulcahy[1], Mr Sudhir Jadhao[1,3], Dr Shivashankar Nagara[1,3], Prof Robert Flower[1,3], Prof Catherine Hyland[1,3]

[1]*Australian Red Cross Lifeblood, Brisbane, Australia,* [2]*School of Health and Behavioural Sciences, University of the Sunshine Coast, Sippy Downs, Australia,* [3]*Faculty of Health, Queensland University of Technology, Kelvin Grove, Australia*

Aim: Accurate *RHD* typing is clinically important, but the *RHD* gene is highly polymorphic. The suitability of the current Reference Sequence (RefSeq) *RHD* gene used to detect gene variants in Indigenous Australians has yet to be defined. This study aimed to investigate the *RHD* gene sequence of Indigenous Australians and compare with RefSeq *RHD* gene (*RHD*01*).

Method: Whole blood samples from 247 Indigenous Australians in Queensland were collected with informed consent. Genomic DNA was extracted and the *RHD* gene was amplified. Amplicons were sequenced on the Illumina custom, targeted Massively Parallel Sequencing (MPS) panel to identify *RHD* zygosity and exonic/intronic variants. Hemizygous *RHD* samples were then selected for whole *RHD* gene sequencing ($n = 2$). Amplicons spanning the whole *RHD* gene were generated by long-range (LR) techniques and then sequenced as 250 bp reads on Illumina MiSeq. Reads were mapped to RefSeq *RHD* (NG_007494.1) using QIAGEN CLC Genomics Workbench for variant detection.

Results: In 247 Indigenous Australians, MPS identified 21 as *RHD*-negative and 226 as *RHD*-positive (122 homozygotes and 104 hemizygotes). Of 226, 21 carried *RHD* gene variants associated with known but rare weak D and partial D phenotypes.

In two *RHD*01* hemizygote samples, LR amplicon analysis detected 60 intronic variants; 12 were common to the two samples and 48 were not. Of these 48 variants, six had not been reported in the Caucasian population[1]: rs28445757 delG, rs1643944507 AAdel, rs376450364 G>A, rs201200089 A>G, rs181068505 G>C, rs145383442 delC.

Conclusion: This study showed a pattern of unusual but clinically significant gene variants associated with weak and partial D phenotypes. There was a contrasting pattern of *RHD* gene variants detected in the exons and introns compared to the reference *RHD* gene. These preliminary findings require further investigation to assemble a reference *RHD* gene for Indigenous Australians.

Acknowledgments: We thank the ANZSBT for the research grant support.

References

1. Tounsi WA, Madgett TE, Avent ND. Complete RHD next-generation sequencing: establishment of reference RHD alleles. Blood Adv 2018;2: 2713–23.

RBCeq: A robust and scalable algorithm for accurate genetic blood typing at population level

Mr Sudhir Jadhao[1], Ms Candice L Davison[2], Dr Eileen Roulis[2], Dr Catherine Hyland[2], Robert Flower[2], Dr Shivashanakr H Nagaraj[1]

[1]*Centre for Genomics and Personalised Health–Qut, Brisbane, Australia,* [2]*Australian Red Cross Lifeblood Research and Development, Brisbane, Australia*

Aim: Repetitive blood transfusion increases the risk of red cell alloimmunisation in patients, which can impact on the timeliness antigen negative blood provision to prevent adverse transfusion outcomes. The International Society of Blood Transfusion (ISBT) currently recognise over 350 blood group antigens represented at varying frequencies in world populations. This level of blood group diversity challenges SNP-array genotyping platforms, which target fewer red cell antigens (35). Comprehensive blood group profiles have been accurately determined from Next Generation Sequence data in the research setting, however a user-friendly automated interpretation pipeline application is lacking. To address this unmet need, we have developed RBCeq, a novel genetic blood typing algorithm.

Method: Blood groups profiling is divided into three steps (1) Extract single nucleotide polymorphisms (SNPs) and copy number variants (CNVs) from NGS data; (2) Genotype and phenotype predictions of known blood groups alleles using novel algorithm; (3) Detection of rare and novel blood group variants by In-silico prediction. All three steps are integrated into a user-friendly web application called RBCeq (https://www.rbceq.org/).

Results: RBCeq is an automated web server-based (https://www.rbceq.org/) software with advanced visualization capabilities and the ability to address the computational and storage challenges associated with large NGS data processing. It profiles 36 blood groups and identifies genomic alterations like indels and CNVs. The RBCeq algorithm was validated on 403 serologically tested samples, which include 58 complex serology cases from Australian Red Cross Lifeblood, 100 samples from The MedSeq Project and a further 239 from Indigenous Australian dataset. The final blood typing data from RBCeq was 99.40% concordant for 402/403 samples (85 different antigens in 21 blood group systems) with that listed from the ISBT database. The RBCeq has extensively redefined blood group profiles in 5757 whole genome sequencing samples from different multi-ethnic cohort.

Conclusion: This platform has the potential to overcome methodological limitation, reduce pre-transfusion testing time and to increase sample-processing throughput, ultimately improving the quality of patient care.

Other ANZSBT Award Winners

Best Poster or Oral Presentation on Haemovigilance (Sponsored by the National Blood Authority)

A comprehensive neonatal-paediatric intravenous immunoglobulin (IVIG) treatment plan developed to improve health care outcomes for children requiring IVIG infusions in Australia

Mrs Dolly Mathew[1], Mrs Jodie Scott[1], Ms Angie Monk[1]
[1]Joondalup Health Campus, Perth, Australia

Aim: Children are sometimes over or under prescribed and/or administered intravenous immunoglobulins (IVIGs). Dose and rate of IVIG infusions differ according to the individual diagnosis and weight of the child. Increased rate of infusion can lead to major complications. A specific IVIG plan designed for neonatal and paediatric patients was required to guide clinicians to prescribe the correct dose and rate of IVIG administration according to the weight of the child. This is a quality improvement initiative.
Method: A new IVIG Treatment Plan was developed in accordance with national guidelines on IVIG administration and expert paediatric advice in one hospital in Perth, Western Australia. The format of the plan includes patient consent, weight of the child, IVIG prescription, diagnosis, or reason for IVIG infusion, IVIG percentage with brand, total dose, and administration time. The administrative section includes the date and time of administration, with a separate area for nurses to sign during the checking process. The plan also includes a section to record the variable rate of infusion (if needed), as well as a section to document bottle usage and compatibility label/s. The final section includes information concerning infusion reactions and subsequent management. The plan was circulated amongst the paediatric multidisciplinary staff for feedback. Positive comments were received from all staff. As a result, the newly developed Neonatal-Paediatric Intravenous Immunoglobulin (IVIG) Treatment Plan was piloted within the Neonatal and Paediatric Departments in early 2021.
Results: The Neonatal-Paediatric Intravenous Immunoglobulin (IVIG) Treatment Plan was universally well received by all staff belonging to the neonatal and paediatric multidisciplinary team. Clinician errors in prescribing the correct dose or rate of administration were reduced and staff stated the plan was easy to understand and use.
Conclusion: The two page Neonatal-Paediatric Intravenous Immunoglobulin (IVIG) Treatment Plan proved to be an effective tool in educating staff and reducing errors when prescribing and administering IVIG products for children.

Transfusion Professionals Free Communication Award in Clinical Transfusion Practice (Sponsored by CSL Behring)

Culturally safe blood transfusion and blood donation for Aboriginal and/or Torres Strait Islander peoples.

Ms Maree Perry[1], Prof Robert Flower[1,2], Prof Catherine Hyland[1,2], Mrs Tracey Spiegel[1], Dr Anastazia Keegan[1], Prof Katherine White[2], Assoc Prof Debbie Duthie[2]
[1]Australian Red Cross Lifeblood, Kelvin Grove, Australia, [2]Queensland University of Technology, Brisbane, Australia

Aim: Aboriginal and/or Torres Strait Islander peoples, and indeed, Indigenous peoples globally, tend to experience a higher than average burden of chronic illnesses that may require treatment with a blood transfusion. Minimal research has been undertaken that focuses on Indigenous perspectives of blood, blood transfusions, and donation. An understanding of the cultural connections blood may represent is helpful to provide culturally safe healthcare.
Method: The researcher, an Nganyaywana (Anaiwan) and Wiradjuri woman, used well-known Indigenous research method 'Yarning' to allow participants to share their experiences through stories. The researcher's community connections aided the recruitment of participants despite COVID. The yarns were recorded, transcribed and analysed using Thematic Analysis with themes identified and collated for analysis. Eleven Aboriginal and/or Torres Strait Islander peoples, with family connections to eighteen different communities 'yarned' with the researcher as well as twelve Health Practitioners who have Indigenous patients.
Results: Two-thirds of the transcripts have been analysed, with the following themes identified so far:

- Blood is a sacred substance and the connection for Indigenous peoples to their to family, land and community.
- Long standing distrust of the health system due to historic poor treatment of Aboriginal peoples by European colonisers has caused delays in seeking or accepting treatment.
- This distrust has been passed on to future generations, causing delays in accessing health care until sometimes it is too late to intervene and save a life.
- Half the Indigenous participants would prefer to know that the blood they are receiving is from an Indigenous person.

Conclusion: Understanding the thoughts, feelings, and beliefs that Aboriginal and/or Torres Strait Islander peoples have about blood, blood donation, and transfusion will provide invaluable information for Health Practitioners to provide culturally safe healthcare.

(Presented in the Oral free communications–Transfusion professionals session)

Immulab Blood Bank Laboratory Award (Sponsored by Immulab)

Type of anti-human neutrophil antigen 3a antibody and potential impact on transfusion-related acute lung injury development

Mr Filip Radenkovic[1,2], Dr Sara Chiaretti[1], Mr Mark Burton[1], Mrs Penny Hassel[1], Dr John-Paul Tung[1], Prof Robert Flower[1]
[1]Australian Red Cross Lifeblood, Brisbane, Australia, [2]Australian Institute for Bioengineering and Nanotechnology, Brisbane, Australia

Aim: Antibodies against human neutrophil antigen (HNA)-3a, expressed on choline transporter-like protein 2 (CTL2), cause severe and fatal transfusion-related acute lung injury (TRALI). Epitope mapping suggests there are two types of HNA-3a antibodies. This study aimed to evaluate the activity of type I and type II anti-HNA-3a antibodies in an in vitro TRALI model.
Method: Granulocyte agglutination test (GAT) and granulocyte immunofluorescence test (GIFT) tested anti-HNA-3a activity in two sera (Q49 and Q50). Flow cytometry tested antibody binding to human or

mouse neutrophils. The monoclonal antibody immobilization of granulocyte antigen (MAIGA) assay was modified to include a rabbit polyclonal antibody (i.e., PAIGA) against an epitope in the third extracellular loop of CTL2, and tested antibody binding to human neutrophils. To model TRALI, human lung microvascular endothelial cells (HLMVECs) were treated with lipopolysaccharide (LPS). Freshly isolated HNA-3aa homozygous neutrophils were added, along with Q49, Q50, or control sera. HLMVEC cytotoxicity and ROS production were measured.

Results: GAT/GIFT confirmed Q49 and Q50 contained anti-HNA-3a antibodies. Flow cytometry showed that Q49 and Q50 bound to human neutrophils, but only Q49 bound to mouse neutrophils. PAIGA showed binding for Q49 but not Q50. These results suggested that Q49 contained type I anti-HNA-3a antibodies that bind an epitope on CTL2's first extracellular loop of CTL2 and that Q50 contained type II anti-HNA-3a antibodies that bind to an epitope spanning CTL2's first three extracellular loops. In the TRALI model, HLVMEC cytotoxicity was observed with both Q49 and Q50, although damage was greater with Q49 treatment compared to Q50.

Conclusion: In this model, differences in HLMVEC cytotoxicity severity were observed between sera containing either type I or type II anti-HNA-3a antibodies. This highlights the importance of further research into anti-HNA-3a-mediated TRALI.

(Presented in the Oral Free Communications – Laboratory session)

ANZSBT Best Poster Prize

Novel insight into platelet refractoriness

Dr Shiying Silvia Zheng[1,2], Dr Jose Perdomo[2], Prof Beng Chong[1,2]
[1]*St. George Hospital, Kogarah, Australia,* [2]*UNSW, Sydney, Australia*

Aim: Platelet refractoriness remains a significant burden in patients with solid and haematological malignancies. Despite the introduction of leucodepletion, 12%–18% of transfused patients still develop allo-antibodies against human leucocyte antigen (HLA).

We aim to (1) elucidate the unexplored Fc-gamma (Fcy) pathway in allo-antibody induced platelet clearance; (2) investigate Fcy inhibitor's capability in alloantibody binding prevention; (3) establish a murine model to examine patients' antibody effect on donor platelets; (4) demonstrate Fcy inhibitor's *in vivo* effectiveness in platelet preservation in the presence of allo-HLA antibody.

Method: The study was approved by the South Eastern Sydney Local Health District Human Research Ethics Committee and the Animal Ethics Committee UNSW. Sera were collected with informed consents from patients with proven HLA alloimmunisation. Healthy donor platelets were incubated with patients' IgG with or without prior treatment with Fcy inhibitor IV.3, followed by labeled anti-human IgG and flow cytometric analysis. A nonobese diabetic/severe combined immunodeficient murine model of platelet refractoriness was established. Donor platelets were transfused into the NOD/SCID mice, followed by examination of human platelet number in the presence of patients' antibodies.

Results: Platelets pre-treated with IV.3 showed substantial reduction in alloantibody binding in all patients ($p = 0.03$ Wilcoxon matched-pairs signed rank test), indicating the importance of Fcy pathway in platelet refractoriness. *In vivo*, HLA alloantibodies induced significant destruction of transfused human platelets, in a dose-dependent fashion. Further murine experiments are in progress, to examine if pre-treatment of donor platelets with healthy immunoglobulins, which non-specifically inhibit the Fcy receptors, can reduce platelet destruction.

Conclusion: We demonstrated that HLA alloantibodies induce platelet destruction via the Fc-gamma pathway. *In vitro* study confirmed the efficacy of Fcy inhibitor in preventing antibody binding. *In vivo experiments* are currently underway. Perspective clinical trials to test its activity in patients are needed.

Oral Free Communications–Clinical

State-wide review of O positive blood for emergency transfusion and rates of alloimmunisation to red cell antigens

Dr Rakin Chowdhury[1]
[1]*Pathology Queensland, Chapel Hill, Australia*

Aim: Analysis of emergency transfusions after implementation of a policy to use O positive blood in female patients ≥50 years of age and male patients >16 years of age. Secondary aim of defining rates of alloimmunisation before and after emergency transfusion.

Method: Retrospective review of emergency transfusions at Queensland public health Hospital between June 2020 and June 2021. Demographic details of the patients transfused emergency blood, indications for transfusion, usage of O positive and O negative blood and rates of alloimmunisation were investigated.

Results: There were 2354 red cell units transfused to 1013 patients during the 12-month period. Most patients were male ($n = 599$, 59%) with the average age being 53 years (IQR 34–72 years). Patients were mostly transfused for trauma ($n = 408$, 39.8%) and gastrointestinal bleeding ($n = 338$, 33%). O positive units accounted for 46.9% (1103 units) of emergency transfusions. However, a significant number of patients were transfused with O negative blood without a recommended indication ($n = 737$ units, 31.3%). Twenty-eight patients (2.9%) had a red cell alloantibody prior to transfusion with the most common being anti-E ($n = 10$), anti-D ($n = 4$) and anti-K ($n = 4$). There was one episode of mild delayed haemolytic transfusion reaction in a patient with prior anti-D. There were 19 patients (4.3%) who developed a red cell alloantibody after emergency transfusion at a median follow up of 22 days with the most common being anti-E ($n = 11$), anti-D ($n = 7$) and anti-C ($n = 5$).

Conclusion: The use of O positive blood for emergency transfusion has resulted in 1103 O negative red cell units being saved with no detriment to patient outcome. Rates of alloimmunisation before and after transfusion were low. There remains further potential to optimize use of O positive blood in emergency transfusion and to understand alloimmunisation rates in a prospective fashion.

Recovery of organ-specific oxygen delivery at restrictive transfusion thresholds after crystalloid treatment for massive haemorrhage and shock in sheep

Dr Wayne Dyer[1], Gabriela Simonova[2,3,4], Sara Chiaretti[2], Mahe Bouquet[3], Rebecca Wellburn[2], Silver Heinsar[3], Carmen Ainola[3], Karin Wildi[3,6], Kei Sato[3], Samantha Livingstone[3], Jacky Y Suen[3,4], David O Irving[1,7], John-Paul Tung[2,3,4,5], Gianluigi Li Bassi[3,4,8,9], John F Fraser[3,4]
[1]Australian Red Cross Lifeblood, Australia, [2]Australian Red Cross Lifeblood, Australia, [3]Critical Care Research Group, The Prince Charles Hospital, Australia, [4]Faculty of Medicine, The University of Queensland, Australia, [5]Faculty of Health, Queensland University of Technology, Australia, [6]Cardiovascular Research Institute, Switzerland, [7]Faculty of Health, University of Technology, Australia, [8]Medical Engineering Research Facility, Queensland University of Technology, Australia, [9]Institut d'Investigacions Biomèdiques August Pi i Sunyer, Spain

Aim: Massive transfusion is indicated for massive uncontrolled haemorrhage, but is this appropriate once haemorrhage is controlled? Current guidelines recommend fluids to restore blood volume and packed red blood cells (PRBC) if haemoglobin <70 g/L (restrictive transfusion threshold). Microcirculatory flow and tissue oxygen delivery are critical for organ and patient survival, but infrequently assessed. Our aim was to evaluate the utility of non-invasive tissue-specific measures to guide Patient Blood Management, and determine physiological outcomes of fluid treatment (PlasmaLyte or novel crystalloid) compared to PRBC transfusion.

Method: A model of massive haemorrhage and shock in sheep, an intensive care setting, with controlled haemorrhage (40%–60% blood volume) to pressure (mean arterial pressure [MAP]: 30-40 mmHg) and oxygen debt (lactate >4 mM) targets. Outcomes were analysed by ANOVA; recovery of haemodynamic parameters, non-invasive sublingual microcirculatory flow, regional tissue oxygen saturation, and arterial lactate, were benchmarked against invasive organ-specific measures of microvascular perfusion, oxygen tension and lactate in brain, kidney, liver, and skeletal muscle. Organ function outcomes were defined by inflammatory and biochemical markers, and post-mortem assessments after 4 h treatment.

Results: Recovery of primary haemodynamic (MAP >65 mmHg and cardiac index >2.5 L/min/m^2) and tissue oxygen delivery (muscle oxygen saturation > 50% and lactate <2 mM) parameters were equivalent ($p > 0.05$) between treatments after 4 h, despite haemodilution after crystalloid infusion to <70 g/L ($p < 0.001$). Recovery of invasive organ-specific perfusion, oxygen tension, and lactate occurred shortly before non-invasive measures indicated recovery. The novel crystalloid supported rapid peripheral vasodilation ($p = 0.014$) and tended to achieve tissue oxygen delivery targets earlier. PRBC supported earlier renal oxygen delivery ($p = 0.012$) but delayed peripheral perfusion ($p = 0.034$). Organ function markers were equivalent.

Conclusions: The outcomes confirmed that restrictive transfusion thresholds support tissue oxygen delivery and recovery.[1] Non-invasive tissue perfusion and oximetry technologies merit further clinical appraisal to guide treatment for massive haemorrhage in the context of Patient Blood Management.

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Transfusion practices in Australian and New Zealand intensive care units: A point prevalence study

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Aim: To describe current blood transfusion practices in intensive care units (ICU), compare them against national guidelines, and describe how point-of-care testing (POCT) is used in guiding transfusion decisions.

Method: We performed a prospective, multicenter point-prevalence study of all adult patients admitted to participating ICUs in Australia and New Zealand (ANZ) on either of two study days in June 2021. Transfused patients were compared to non-transfused patients; multivariate regression was used to assess effects of transfusions on outcomes after adjusting for confounding variables. Clinical reasons and triggers for transfusion were compared to ANZ patient blood management guidelines.

Results: Out of 712 adult patients from 51 ICUs, 10% of patients received a transfusion. Compared to patients not transfused, these patients had higher Acute Physiology and Chronic Health Evaluation (APACHE) II scores (18.9 vs. 16.7, $p = 0.02$), and a greater proportion were mechanically ventilated (49.3% vs. 37.3%, $p < 0.05$), received vasopressors (53.5% vs. 30.7%, $p < 0.01$), and had systemic inflammatory response syndrome (70.4% vs. 51.3%, $p < 0.01$). Most transfused patients (8.9% of all patients) received red blood cell (RBC) transfusions, and only 1.4% received platelets, 0.8% fresh frozen plasma (FFP), and 0.7% cryoprecipitate. POCT was available in 82.4% of sites but only used in 9.5% of transfusions involving platelets, FFP, or cryoprecipitate. Alignment with guidelines was found for all RBC transfusions, but disagreement was up to 53.8% for platelet transfusions, 57.1% of FFP transfusions, and 80.0% of cryoprecipitate transfusions. In both univariate analysis and after adjustment for confounding, blood transfusion was not significantly associated with mortality or length-of-stay.

Conclusion: RBC transfusions in ICU are aligned with guidelines, but non-RBC transfusion decisions are often not. POCT is commonly available but not often the reason for transfusion decisions.

Introduction of fibrinogen concentrate for critical bleeding in South Australia

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Aim: Fibrinogen Concentrate (FC) use in critical bleeding is not currently available through national blood supply. SA Health independently purchased FC as part of COVID-19 contingency planning. FC doses were allocated to SA public hospitals and the MedSTAR Retrieval service based on historical cryoprecipitate use. Protocols developed by the State Critical Bleeding Advisory Group included a threshold of FIBTEM levels ≤6 and ≤8 for use in critical and obstetric bleeding where thromboelastometry (ROTEM) testing available. A single dose (4 g) was used; patients requiring additional doses were transfused with cryoprecipitate. The aim of this study is to examine use of FC in first 22 months of availability.

Method: RedCAP Database was used to capture the use of FC. Data collected included patient demographics, physiological, laboratory + ROTEM, blood and blood product use and patient outcomes.

Results: 64 patients used 246 g of FC between July 2020 to April 2022 and of those 40 received hospital trauma activations. Median time (interquartile [IQR]) from the start of ROTEM measurement to commencement of FC infusion was 34(22–55) min. Median time from start of ROTEM measurement to dispensing FC from laboratory or Emergency Department Blood fridge was 18(10–41) min. Median time from dispensing FC to commencement of patient administration was 14(8.5–20) min. Median FIBTEM A5 was 5 mm (IQR 4–6) pre-FC and 11 mm (IQR 9–13) post FC administration. Patients received a median of 5(2–10) red cell units, 4(3–8) FFP units, 2(1–3) platelets units and 1(1–2) adult doses of cryoprecipitate. Overall, in-hospital mortality was 15.6%.

Conclusion: About 40% of FC doses commenced within 30 min of ROTEM testing. Considering a longer median time to administration of cryoprecipitate, we have identified a patient cohort with severe coagulopathy who may benefit from rapid access to fibrinogen replacement in the form of FC.

Oral Free Communications–Laboratory

Understanding the biology of the Kidd blood group protein in the erythroid cells of control and Jk-null individuals

Dr Genghis Lopez, Ms Fenny Chong, Ms Glenda Millard, Ms Tanya Powley, Prof Catherine Hyland, **Dr Rebecca Elizabeth Griffiths[1]**
[1]*Australian Red Cross Lifeblood, Kelvin Grove, Australia*

Aim: To identify and characterise the molecular basis for the Jk(a–b–) phenotype in Australian blood donors and decipher the biological consequence using our ex vivo model of erythropoiesis to help inform clinical transfusion practice.

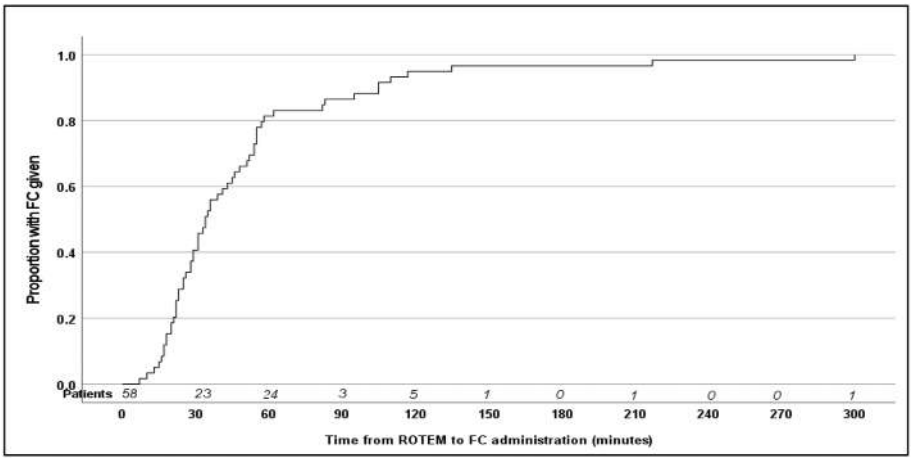
Kidd (Jk) blood group antigens are present on the red blood cell (RBC) membrane urea transporter (UT-B) glycoprotein. In many populations, the Jk(a–b–) phenotype is absent or rare, making provision of blood for patients requiring this phenotype challenging.

Method: DNA was extracted from routine EDTA blood samples and analysed using whole exome sequencing to determine the molecular basis of the Jk phenotype ($n = 6$) [1].

To characterise UT-B expression during erythropoiesis, haematopoietic stem cells were isolated from the Jk(a–b–) donor whole blood collection's buffy coat and differentiated to RBCs using an established erythropoiesis model [2]. The expression of the UT-B protein and other erythroid proteins were examined throughout erythroid differentiation by flow cytometry and confocal microscopy.

Results: DNA sequencing showed all 6 donors with the Jk(a–b–) phenotype were homozygous for *JK* c 0.342-1G>A polymorphism resulting in the *JK*02N.01/*02N.01* genotype.

Preliminary data suggest that the UT-B protein is produced in the Jk(a–b–) phenotype during erythropoiesis but does not appear to sort correctly to the plasma membrane. As the Jk(a–b–) erythroid cells mature, the UT-B protein is cleared from the cells.



Conclusion: RBCs with the *JK*02N.01/*02N.01* genotype exhibit a null Kidd blood group phenotype attributed to the c.342-1G>A splice site variant that is predicted to generate a truncated protein due to exon skipping in protein synthesis. Our data suggest the production of a misfolded protein, which is cleared by the RBCs during erythroid maturation and not integrated onto the membrane.

Understanding the biological basis and consequence of genotype variants may enhance the ability to predict the potential clinical significance enabling better-informed transfusion management when supply of serological compatible blood is limited.

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Intertwining roles for genomics and international data sharing defines a novel low prevalence Kell antigen in a blood donor

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Aim: To date the KEL blood group system comprised 37 antigens. The most recently discovered KEL antigen, named KHIZ, was acknowledged in 2022 by the International Society of Blood Transfusion (ISBT) Working Party (WP) on Red Cell Immunogenetics and Blood Group Terminology; the ISBT WP responsibilities include accepting, registering and curating all red cell antigens and alleles.

The KHIZ antigen was reported because of an investigation of a patient who presented with an antibody to a high-prevalence antigen. [1] Genomic whole exome sequencing studies revealed the patient was homozygous for a c.1538G>A change on exon 14 of the *KEL* gene, predicting a p.Arg513Gln on the Kell glycoprotein. This has been recognised as defining a high-prevalence antigen involving the p.Arg513. We will present a case study of a patient with an antibody to a proposed antithetical low-prevalence antigen to KHIZ.

Method: Standard serological techniques were used to investigate the antibody specificity. Blood samples from a red cell incompatible donor were provided for genomic sequencing using the TruSight One panel and Massively Parallel Sequencing (MPS).

Results: Serological investigation of the patient following a transfusion reaction suggested the antibody specificity was directed to an antigen in the KEL system. Sequencing showed that the incompatible donor was heterozygous for *KEL* c.1538G/A (GenBank accession number MG818162) predicting p.Arg513/p.Gln513. There were no other significant *KEL* gene blood group variants.

Conclusion: The p.Gln513 is responsible for a low-prevalence antigen on the Kell glycoprotein, with the proposed name KHOZ. The International data and our genomic-based study suggest that the KHIZ and KHOZ are antithetical antigens on the Kell glycoprotein. Both were defined by genomic studies but in previous years, such cases may have remained unresolved for many decades. This study shows the value of involvement and data sharing through presentations with the ISBT Working Parties.

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The use of multi-colour imaging flow cytometry to identify platelet subpopulations during extended cold-storage

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Aim: Platelets for transfusion are stored at room temperature (RT), limiting their shelf life to 7 days. Cold storage (refrigeration) of platelets is attractive as it could extend the shelf life to 21 days, whilst providing a haemostatic advantage to the platelets. Cold storage induces the progressive externalisation of phosphatidylserine, which is a

	Day 1	Day 7		Day 21	
	Pool	RT	Cold	RT	Cold
Procoagulant (%)	0.4 ± 0.2	0.9 ± 0.2	4.3 ± 1.8*	12.0 ± 2.2	20.4 ± 5.8*
Apoptotic (%)	0.3 ± 0.2	0.4 ± 0.1	0.2 ± 0.1*	9.1 ± 5.1	0.9 ± 0.7*

Data represents mean ± *SD*; * indicates $p < 0.05$ compared to RT at same time-point.

feature of both procoagulant and apoptotic platelet subpopulations. As such, the aim of this study was to identify the subpopulations present in platelet components during extended cold storage.

Method: Platelets from fresh components ($n = 6$) were either unstimulated or stimulated with thrombin and collagen, calcium ionophore (A23187) or ABT-737 to generate resting, aggregating, procoagulant or apoptotic platelets, respectively. In parallel, platelet components ($n = 6$) were stored for 21 days under RT (20–24°C) or cold (2–6°C) conditions. Multi-color fluorescent marker panels were designed to identify platelet subpopulations by the presence ($^+$) or absence ($^-$) of staining with: annexin-V (AnnV), CD61, PAC-1, CD42b, GPVI, CD62P and tetramethylrhodamine ethyl ester (TMRE). The phenotypic profile of platelets was determined by imaging flow cytometry (Amnis ImageStreamX Mark II).

Results: Both procoagulant and apoptotic platelets were AnnV$^+$, CD61$^+$, GPVI$^-$, PAC-1$^-$ and TMRE$^-$, making identification of the subpopulations difficult when these markers were used in isolation. However, the combination of AnnV, CD42b, and PAC-1 separated resting, aggregating, procoagulant and apoptotic platelet subpopulations. Using this panel, a greater proportion of procoagulant (AnnV$^+$/CD42b$^+$/PAC-1$^-$) platelets was evident during cold-storage by day 7; whereas RT-storage promoted the appearance of apoptotic (AnnV$^+$/CD42b$^-$/PAC-1$^-$) platelets (see Table). This trend continued throughout 21 days of storage.

Conclusion: Storage temperature differentially drives the development of procoagulant and apoptotic platelet sub-populations. This data suggests that the enhanced haemostatic potential of cold-stored platelets may be due to the preferential development of procoagulant platelets.

Concordance analysis between genetically and clinically determined blood cell antigen types using the two array formats developed by the blood transfusion genomics consortium (BGC)

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[1]*Australian Red Cross Lifeblood, Kelvin Grove, Australia; on behalf of the Blood transfusion Genomics Consortium*

Aim: To perform concordance analysis between clinically and genetically determined blood cell antigen types obtained using the UK Biobank_v2.2 array (UKBB_v2.2) and Universal Blood Donor Typing (UBDT_PC1) developed by the BGC.

Method: The BGC is an international partnership between blood services, research institutions, and industry leaders with the aim to improve the safety and efficiency of blood and platelet transfusion by introducing cutting-edge genomics technology into routine clinical practice. Nine blood services have come together to share DNA samples and antigen typing data on 14 000 donors to deliver a validation study on a powerful array platform. So far half ($n = 6952$) of the samples have been tested, with 1974 in 4 labs, 4512 samples have been tested in 3 labs and all 6952 have been tested in two labs to compare the performance of two array formats with antigen typing data held on Electronic Donor Record. The arrays and interpretation workflow can type all clinically relevant Human Erythroid Antigen (HEA) systems and can also type Human Leukocyte Antigen (HLA), Human Platelet Antigen (HPA) and markers for iron homeostasis and restless leg syndrome. The UBDT_PC1 array is currently being assessed by Lifeblood in Brisbane with the aim to evaluate its performance on DNA samples from the Australian population.

Results: Preliminary results show concordance of 99·85% with Human Erythroid Antigen (HEA) typing data with only a small number of discordances. This is the largest multi-center study to date comparing performance of a new genotyping array between four laboratories testing samples from an ethnically diverse panel.

Conclusion: The results obtained for the concordance analysis confirmed the high accuracy of the array and interpretation pathway for typing all clinically relevant HEA systems. Access to accurate and cost-effective typing such as provided by these arrays, can revolutionise treatment for patients where better-matched blood can prevent alloimmunisation and simplify long-term transfusion support.

Oral Free Communications–Transfusion Professionals

Increasing safety and awareness of *RHD* immunoglobulin through haemovigilance reporting

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RHD immunoglobulin (RhDIg) use in Australia is likely to have significantly reduced infant mortality from haemolytic disease of the newborn; however, errors in RhDIg use occur.

Blood Matters Serious Transfusion Incident Reporting (STIR) system has collected RhDIg administration incidents since 2015. To further enhance our understanding of RhDIg issues, STIR commenced reporting of *RHD* isoimmunisations in 2020.

Aim: Increase safety and reduce risks, by understanding errors associated with RhDIg administration.

Method: Reporters notify STIR of the event and are sent an investigation form to complete, which is then reviewed by members of the STIR expert group.

An annual report of all validated reactions and incidents is made available and de-identified information from investigations is used to support education and audit.

Results: From January 2015 – June 2021, STIR validated 92 events: These included (percentage of RhDIg incidents)

- 30%, dose omitted
- 26%, inappropriate administration including use in *RHD* positive women, *RHD* negative woman with *RHD* negative infant, women with pre-formed immune anti-D

- 7%, wrong dose
- 7%, delayed administration >72 h
- 30%, other (near miss, storage and handling)

Most errors occur in the maternity clinics or wards, with a small number happening in emergency departments or theater.

RHD isoimmunisations: Currently there is one confirmed report, in a woman who appears to have received all appropriate prophylaxis, however was likely isoimmunised and not fully investigated at the start of her pregnancy. Full details of prophylaxis in a previous pregnancy were not available.

Conclusion: These incidents indicate multi-faceted process problems. Recommendations for improvement include appropriate education for health professionals involved in maternity care, standardised reporting of maternal *RHD* status, positive patient identification, and regular auditing to identify areas for improvement. Blood Matters continues to work with maternity care providers to improve practice, including education of the updated RhDIg guidelines.

Keeping it safe from transfusion to transport: The development of tailored transfusion resources for regional and remote Western Australia

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[1]*Pathwest Laboratory Medicine, King Edward Memorial Hospital, Subiaco, Australia,* [2]*Australian Red Cross Lifeblood, Perth, Australia,* [3]*WA Country Health Service, Central Office, Perth, Australia,* [4]*Australian Red Cross Lifeblood, Adelaide, Australia*

Aim: To understand the unique challenges and educational requirements of clinicians who care for patients requiring transfusions across regional and remote WA and develop tailored clinical support tools to empower them to deliver safe transfusion practices.

Method: The project team used active research methodology to engage with stakeholders across regional and remote WA (online questionnaire) and invited key stakeholders to participate in 1.5 days workshop to understand and define their learning needs. Based on this information, the project team created a suite of innovative clinical support tools tailored to these needs. A post implementation evaluation (online questionnaire) will assess the impact of the project.

Results: 87 clinicians from across WA Country Health Service participated in the online questionnaire. 82% received training on safe transfusion but only 38% had received it within the last 2 years. 62% felt "completely confident" to transfuse red cells however 9% felt "either somewhat", "a little" or "not confident at all". Adverse transfusion reactions (90%) and blood administration (77%) were the leading learning needs identified as well as specific requests for training on regional blood transport. Clinicians preferred to receive their transfusion education via e-learning (87%), scenario-based learning (46%), checklists (44%) or lanyard cards (39%).

The project team created a suite of innovative clinical support tools including (1) printed resource illustrating key steps in the safe administration of red cells based on local policies with QR code to improve accessibility to the ANZSBT guidelines, (2) scenario-based e-learning module for recognising and responding to adverse transfusion reactions and (3) printed resources with QR code to a video demonstrating the key steps to safely transporting blood to prevent wastage.

Conclusion: Clinicians who care for patients requiring transfusions across regional and remote WA appeared to welcome the opportunity to guide the development of tailored resources to allow them to deliver safer transfusion practices.

The prevalence of alloantibodies in a cohort of Indigenous and non-Indigenous cardiac surgery patients

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Aim: There is very limited evidence on prevalence and specificity of red cell (RC) antibodies in Aboriginal and Torres Strait Islander peoples (herein respectfully referred to as Indigenous). We examined the prevalence of RC antibodies in Indigenous and non-Indigenous patients

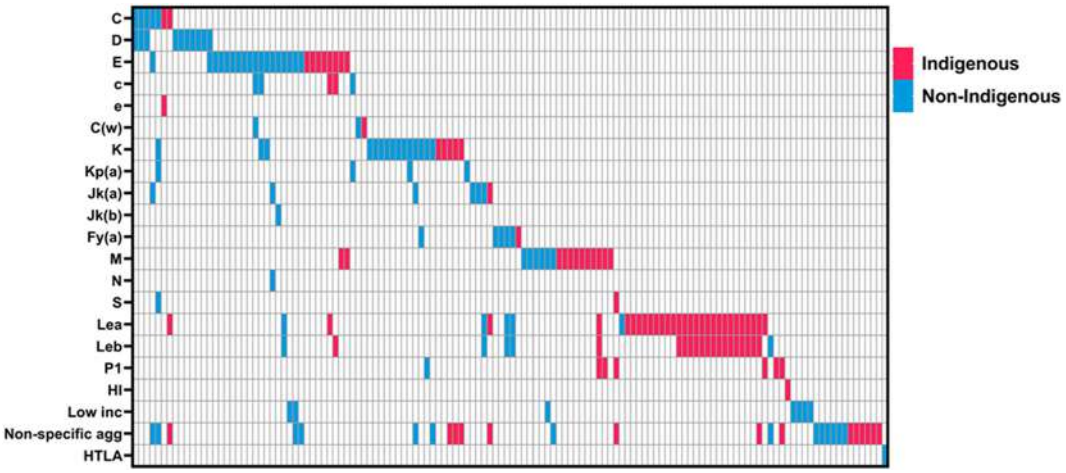


Figure 1 Alloantibodies detected in Indigenous versus non-Indigenous patients (columns represent individual patient data)

undergoing cardiac surgery at a South Australian (SA) tertiary hospital that is the referral centre for Northern Territory (NT) patients.

Method: Indigenous and non-Indigenous patient's ABO & *RHD* blood groups and RC antibodies at the time of surgery and up until 2021 were retrospectively analysed for all consecutive patients undergoing cardiac surgery at Flinders Medical Centre between January 2014 and June 2019.

Results: 2327 patients were included, 420 (18.0%) Indigenous and 588 (25.3%) from the NT. Indigenous patients had higher prevalence of ABO group O (59.5% vs. 43.6%) and *RHD* positive (98.8% vs. 83.6%) blood groups. 132 patients had RC alloantibodies detected, 63/420 (15%) Indigenous versus 69/1907 (3.6%) non-Indigenous ($p < 0.0001$). Lewis, P1, and M IgM alloantibodies were more common in Indigenous patients (Figure 1). 101 patients had antibodies detected at time of surgery. 16 NT patients (15 Indigenous, 1 non-Indigenous) with previously detected alloantibodies, on average 7.7 years prior to surgery, presented with a negative antibody screen at time of surgery in SA. These included anti-Kell, C, E, and e alloantibodies.

Conclusion: We found a high prevalence of alloantibodies, particularly IgM class in Indigenous patients undergoing cardiac surgery. Such antibodies, though not necessarily clinically significant, may cause delays in finding crossmatch compatible blood, particularly in rural and remote settings. Our subset of NT patients with previously identified clinically significant alloantibodies not present at time of surgery in SA support the need for a national antibody transfusion register.

Mapping South Australia's laboratory and satellite bloodstocks–Uncovering surprise stocks of O negative red cells

Mr Rick Tocchetti[1], Ms Cathie Gore[1], Dr Romi Sinha[1], Ms Susan Ireland[1]

[1]*SA Health, Adelaide, Australia*

Aim: Map the O Neg red cell (ONegRC) holdings in the transfusion laboratories and partnered satellite hospital sites in South Australia (SA).

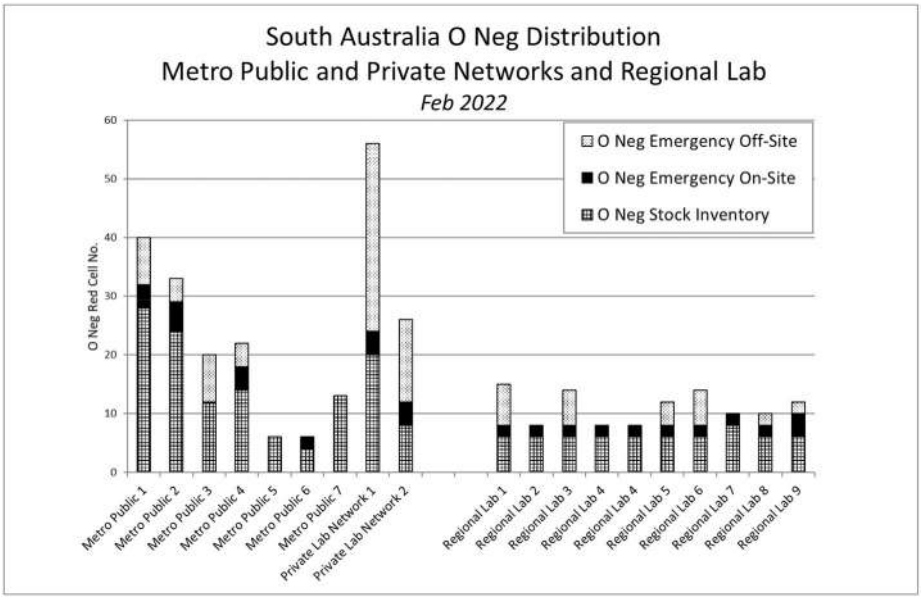
Method: An audit was conducted on all SA public, private, metropolitan, regional hospital and laboratory sites to determine their ONegRC holdings that were classified as unallocated stock and/or allocated on-site as emergency standby blood, that is, ONegRC ready for emergency issue usually as part of a massive transfusion pack or similar standby in lab or emergency department stock. Off-site emergency ONegRC stocks were also audited to determine levels and locations.

Results: For metropolitan and regional labs, the ONegRC stock inventory was commonly supplemented by a small no. of on-site emergency standby ONegRC plus varying amounts of off-site ONegRC holdings. The off-site arrangements were in place to deal with concerns regarding potential lab supply delays often linked to geography.

Conversely, a large amount of off-site ONegRC were observed with the hospitals supported by private lab networks. These off-site holdings were generally larger than their own lab stock inventory. Possible reasons are the adoption of the group and hold protocols for surgical procedures with a low crossmatch to transfusion ratio with a parallel reduction in the matched blood held. Holding ONegRC provides some assurance of blood being available for transfusion in cases of unexpected peri-operative bleeding.

Not unexpectedly, a large portion of ONegRC in SA are located in various public and private hospitals without on-site labs as emergency standby blood.

Conclusion: Mapping the ONegRC inventories, together with an assessment of historical usage and clinical risk, will inform targeted supply and threshold adjustments as well as support discussion on the adoption of possible alternative practices such as the transferring to holding O Pos red cells as emergency inventory.



Posters

Transfusion considerations in sickle cell disease: Alloantibodies and hyperhaemolysis

Dr Stephanie Anderson[1], Dr Devika Remash[1], Ms Lynette Ackerman[1], Dr Scott Dunkley[1]
[1]*Department of Haematology; Royal Prince Alfred Hospital, Sydney, Australia*

A 37-year-old man with sickle cell disease developed a chest crisis following withdrawal of hydroxycarbomide therapy for fertility treatment. Clinically, the patient required a red cell exchange but was known to have a historical anti-C, anti-Doa, anti-Jkb, and anti-Fya. Anti-Fy3 had been suspected but was excluded as genotyping revealed a Duffy silencing mutation. There was also another suspected alloantibody that remained unidentified despite reference laboratory investigation.

On this occasion, testing of the patient's plasma revealed panagglutination on a 3-cell screen and 11-cell antibody identification panel. Extensive investigation by tube, CAT, IAGT, enzyme and referral of fresh sample to reference laboratory failed to identify specificity of antibodies present. Due to clinical deterioration, the patient proceeded to red cell exchange using eight genotype-matched, but crossmatch incompatible red cell units, by IAGT. Units selected for transfusion were A- or O-positive, C-negative, K-negative, Fya-negative, Jkb-negative, and S-negative. Doa-negative units were not available.

The patient re-presented 8-days later with symptomatic anaemia and biochemical evidence of haemolysis. His haemoglobin fell from 103 g/L on discharge to 41 g/L. A delayed transfusion reaction with hyperhaemolysis was suspected and he was pulsed with methylprednisone. Privigen (2× 65 g) was administered. Patient blood management principles were enacted including prescription of erythropoietin and folate. However, given the risk of developing a second crisis due to severe anaemia and reports of exertional angina, the decision was made to transfuse with one unit of the least incompatible red cells. The patient's haemoglobin incremented to 73 g/L following a second unit. He was discharged without evidence of further haemolysis.

This case highlights the importance of involving haematology in all aspects of sickle cell patient care, the investigative pathway for complex alloantibody cases and above all, the importance of patient blood management in high-risk haemoglobinopathy patients.

Unexplained long persistent allo-antibody to RhC in a patient with warm autoimmune haemolytic anaemia

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Aim: To present a case with exceptionally long persistence of a red blood cell (RBC) allo-antibody, and to consider factors that may explain it.

Method: Case report and literature review.

Results: An 89 years old female with warm autoimmune haemolytic anaemia (WAIHA) was found to have an allo-anti-C after allo-adsorption of native plasma. This was consistent with her Rh phenotyping, which showed that she was C-. We believe the initial stimulus for this allo-anti-C occurred was a pregnancy at least 57 years prior. Her son, 57 years old, was found to be C+, and moreover had suffered with neonatal jaundice. We also confirmed–from records, and from the patient directly–that there had been no subsequent allo-immunising events.

Treatment with phenotype-matched RBC transfusions and steroids was successful. To consider further the long-persistent allo-anti-C, we examined her HLA class II phenotype. This was *DRB1*07:01:01*, *DRB1*15:01:01*, *HLA DQB1*02:02:01*, **06:02:01* and *HLA DQA1*01:02:01*, **02:01:01*.

Incidentally, 44 years is the longest recorded persistence of an anti-Rh allo-antibody (anti-D and anti-C) we found in the literature. *HLA-DRB1*15*, and *HLA-DQB1*06* are associated with development of multiple RBC allo-antibodies. Interestingly, HLA-DQ6 has been reported as protective against WAIHA. We considered other explanations for the persistent allo-anti-C including molecular mimicry, and WAIHA itself.

Conclusion: We report a very persistent, not-fully-explained, allo-anti-C in a patient with WAIHA. The association of *HLA DRB1*07:01:01*, *DRB1*15:01:01*, *HLA DQB1*02:02:01* with not merely alloimmunization to RhC, but the long persistence of allo-anti-C needs to be examined. Patients with long-persistent antibodies pose clinical challenges, and there is insufficient information on the risk factors for this. A reliable, clear, and comprehensive history of prior immunizing events is important to understand and resolve RBC antibody issues.

Delivering virtual education, the silver lining to our COVID cloud

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Background: One aspect of the Blood Matters Program is providing education to clinical staff throughout Victoria. In March 2020, the ability to deliver in-person education ceased due to COVID-19 pandemic lockdowns. Accordingly, the Blood Matters blood management/transfusion education went virtual.

Aim: To provide safe and easily accessible high quality blood education throughout Victoria to meet the clinical need.

Method: A user-friendly virtual education platform was used to deliver blood management/transfusion education. Each session was delivered live and recorded. Attendance and registration data captured. Recorded events distributed to all registrants, including those not able to attend. Events were evaluated.

The virtual education attendance and time were compared to similar in-person education conducted in 2018–19.

2020–2021 virtual	No. events	Average attendance/ event	Total	Time (h)/ event	Total (h)
5 topics in 5 days series	3	95	285	5	15
EN series	3	15	44	4	12
Private health series	2	26	52	4	8
5 topics in 5 days for midwives	1	47	47	5	5
Other	5	122	608	1	5
Total	14	74	1036	20	45

2018–2019 in-person	No. events	Average attendance/ event	Total	Average time (h)/ event	Total (h)
Regional days	12	21	252	6	72
EN days	2	24	48	7	14
Short sessions	21	17	362	2.5	53.5
Total	35	19	662	15.5	139.5

Results: Event recordings have been sent to >1500 registrants, with many intending to share with colleagues.

Over 90% found the platform easy to use and would recommend the education to others.

Conclusion: In the last 2 years Blood Matters have provided time effective education beyond Victoria, with participants across Australia; resulting in education reaching a greater audience in less time. Virtual education reaching 23 persons versus 4.7 in-person for each hour. Attendance and the feedback support our COVID silver lining of virtual education, and it will continue.

Is the introduction of an electronic medical record (EMR) meeting pretransfusion sample collection safety requirements?

Ms Kaylene Bastin[1], Ms Linley Bielby[1], Ms Christine Akers[1], Ms Rae French[1], Ms Bridget Glazebrook[1], Dr James Daly[2], Mr Peter Beard[1]

[1]*Blood Matters, West Melbourne, Australia,* [2]*Australian Red Cross Lifeblood, Brisbane, Australia*

Aim: To identify the number of health services using EMR for pretransfusion sample collection.

Method: 131 health services from 4 Australian jurisdictions were invited to participate in an EMR survey. Multidisciplinary experiential and objective data were sought.

	Number health services
EMR test request with an EMR generated paper request form	10
EMR test request only	1
Paper only	2
EMR generated labels	7
Handwritten labels	4
Unique staff identifier entered	1
Signing a printed form	10
Scanning the patient ID pre-sample collection	7
Post collection scanning of sample labels	4
Safety data	
Increase in sample errors	2
Increase in WBIT	2
Decrease in sample error	2 sustained
Decrease in WBIT	2 (1 sustained)

Results:

- 111 individual responses from 59 health services
- 51 from 20 health services (34%) reported using an EMR
- 34 from 11 health services (55%) reported using an EMR for pretransfusion sample collection

Specific aspects of pretransfusion sample collection pertinent to patient safety were analysed as reported below.

The pretransfusion test request method varied between departments within 2 health services.

One health service uses an electronic signature or equivalent to confirm correct patient identification and sample labeling process. All others use a printed form signed by the collector.

Conclusion: Pretransfusion sample collection is used by 55% of health services with EMR. Many have a hybrid system, with handwritten blood sample labels and printed request forms with the collector's declaration, which may negate some of the safety benefits of an EMR. Patient ID band scanning with post sample collection tube scanning, which can help with matching the sample to the patient, is performed by a minority of health services.

The variation in responses for sample error and WBIT rates may relate to system differences and respondent roles. Understanding the experience of those with an EMR, can improve system and patient safety.

Stop the bloody waste

Mrs Karen Beattie[1]

[1]*WNSWLHD, Orange, Australia*

Aim: Blood is a precious, generously donated product that costs $399 per unit. Emergency O negative red blood cell (RBC) wastage in a small rural facility blood fridge was 38%. The aim of this project was to reduce emergency red blood cell wastage from a satellite blood fridge in a small NSW rural hospital to 6% by April 2021.

Method: RBCs are transported to facilities, with no transfusion laboratories, in blood shippers and stored in satellite blood fridges. An improvement science framework was employed for this project to understand the causes of RBC wastage and implement change ideas. Pre-implementation and post implementation waste data and staff knowledge surveys were collected. Pre-implementation, 60% of total RBC wastage was attributed to clinician error. Simulated blood shipper deliveries from a transfusion laboratory were employed to test solutions and implement sustainable practice changes.

Results: This project led to a 47% reduction in emergency RBC wastage. The aim of 6% wastage was not achieved; however, wastage was trending down at completion of the project. The project demonstrated a 16%–32% improvement in clinician familiarity with blood fridge procedures. On completion, a statistically significant number of surveyed participants did not require additional education regarding the blood fridge (12% pre-implementation verse 73% post-implementation).

Conclusion: Pre-implementation, pathology services and health professionals operated in silos, with poorly defined roles and responsibilities. Engagement with key stakeholders and the formation of collaborative partnerships was necessary to ensure project success. Incorporating existing procedures from NSW Health Pathology into the Western NSW Local Health District project solutions was essential for sustainability and overall governance. Simulated blood shipper deliveries proved an excellent tool to test solutions and improve clinician familiarity with mandated procedures and reduce emergency RBC wastage.

A case of allo anti-D in a pregnant woman with the *RHD*0.1N.25* variant allele

Ms Emily Black[1]

[1]*Australian Red Cross Lifeblood, Kelvin Grove, Australia*

Initial Results: A sample from a 36 year old woman, 20 weeks gestation, was referred to the Australian Red Cross Lifeblood for Non-Invasive Prenatal Assessment (NIPA) for fetal RHD. The referring laboratory indicated the patient was A RHD negative and had allo anti-D with a titre of 128. NIPA testing was inconclusive as results suggested a maternal RHD variant was present. RHD genotyping from maternal genomic DNA was a possible D positive, with a low signal at c.340 C>T by a commercial RHD genotyping kit.

Next Steps: Phenotyping was performed by the Red Cell Reference laboratory as A C+ E− c+ e+ K− Fy(a+b+) Jk(a+b−) M+ N+ S+ s+ Rh33+ Rh43+. RHCE genotyping was performed to eliminate possible RHCE variants, and none were detected. Antibody identification confirmed the presence of anti-D and titre of 128. An adsorption/elution with anti-D using the acid glycine method was performed. Anti-D wasn't eluted. The sample was referred for RHD sequencing with results indicating a heterozygous nucleotide substitution (c.336-1G>A), leading to a splice site change at the intron 2/exon 3 boundary of RHD. This variant defines the *RHD*0.1N.25* allele and a RHD negative phenotype expression.

Patient Management and Clinical Outcome: A sample from the patient's partner was referred for RHD Zygosity testing. The partner was confirmed as homozygous for RHD, indicating the fetus would be RHD positive. Prior to delivery, the patient's anti-D quantitation rose to 12.4 IU/mL with the titre rising to 1028. During delivery, she had a 1st degree tear with an estimated 800 mL blood loss. The newborn required phototherapy due to mild jaundice, with bilirubin levels peaking at 153 μmol/L.

Conclusion: This is the first reported case of allo anti-D in a patient with the *RHD*0.11/0.25* variant allele. Laboratories performing NIPT for RHD should consider the impact of RHD variants on the interpretation of their results.

WA antibody register replacement

Ms Tanya Cawthorne[1], Mr Bryan Bourke[1], **Mrs Tanya Powley[2]**, Dr James Daly[2], Mr Wayne Bolton[3]

[1]*Australian Red Cross Lifeblood, Perth, Australia,* [2]*Australian Red Cross Lifeblood, Brisbane, Australia,* [3]*Australian Red Cross Lifeblood, Melbourne, Australia*

Aim: To replace the historical Western Australian Antibody Register (ABR) with a new cloud hosted system and migrate the historical data, ensure that the system complies with modern security and privacy requirements, and can easily be accessed by Approved Health Provider's (AHPs).

Method: Replacing the ABR was a Lifeblood agile project. Microsoft Azure DevOps was used to capture project requirements in the form of epics, features, and user stories. Each functional user story delivered was tested prior to being marked as complete. Throughout the project, stakeholders and users of the system were showcased the working functional software, to seek and incorporate feedback into the project build.

The ABR was constructed within the Lifeblood landing zone of Amazon Web Services (AWS). It utilises best practice cloud security features, including but not limited to; authentication solutions, firewalls, network restrictions and permissions matrixes.

Following consultation with Legal representatives and consultants, the new ABR was built around an opt-in patient consent management process.

Results: The new cloud hosted ABR was built in-house by Lifeblood who is also responsible for ongoing maintenance and support. 36 601 records were successfully migrated. Lifeblood works collaboratively with AHP's to ensure the data added to the register is current and only people who have provided their consent for inclusion in the register can be searched and viewed. The personal data is secure and can only be accessed by individual authorised users of the system.

Conclusion: The replacement ABR was successfully launched in March 2022 and all Western Australian AHPs were provided access to the system in April 2022. The system gives pathology laboratories timely access to the critical information they need to support patients who require specialised blood components. This information:

- assists with red cell antibody identification
- enables the provision of appropriate blood
- reduces the risk of delay in supply
- reduces the risk of haemolytic transfusion reaction

Anti-cra case study; difficulties in donations from a rare phenotype

Mr Bryan Bourke[1], Ms Amy Tearle[1], Mr Brett Wilson[1]
[1]*Australian Red Cross Lifeblood, Perth, Australia*

Aim: Identification of a rare Cromer blood group antibody in a Zambian patient and the appropriate transfusion management, including autologous blood donation.

Method: Whole blood samples were analysed by various serological techniques to identify any antibodies present. Phenotyping was performed using a combination of commercial and rare antisera. Antibody activity was inhibited using recombinant Decay Accelerating Factor (srDAF). Genotyping was completed using Immucor BioArray HEA Precise BeadChip and TruSight One sequencing panel.

Results: The plasma was reactive with all cells tested by column agglutination technology (CAT) and tube indirect antiglobulin test (IAT) methods; however, the antibody was non-reactive by NEO solid-phase method. DAF protein inhibition indicated the presence of a Cromer system antibody. Cr(a-) phenotype was confirmed serologically. The patient's cells showed variable reactions with M and S antisera.

HEA BeadChip analysis was unsuccessful.

CD55 gene variation in the Cromer system was detected by sequencing, with homozygosity for the nucleotide substitution c.679G>C, which is responsible for the Cr(a-) phenotype. An MNS system variant was also detected resulting in the GP. He hybrid glycophorin.

Conclusion: Difficulties in relation to blood transfusion arise when confronted with anti-Cr^a antibodies. This case was further complicated by the presence of other inconsistent phenotyping results attributed to a variant glycophorin present. Nucleotide polymorphisms giving rise to this variant glycophorin may be responsible for an unsuccessful HEA BeadChip read.

Although our patient's haemoglobin levels returned to normal, ambiguity surrounds the suitability of autologous donations due to our patient possessing sickle cell trait. Processing of such a donated unit may encounter problems at the leucocyte filtration step, along with possible haemolysis associated with freezing and thawing of donations due to red cell fragility.

As Cromer system antibodies are seldom responsible for HTRs, antigen negative blood is not usually required for transfusion and least incompatible crossmatched blood is generally suggested, with Cr(a-) units potentially being sourced for strong examples of anti-Cr^a.

Twenty years of being BloodSafe in South Australia

Mrs Amanda Catherwood[1], Dr Kathryn Robinson[2], Mr Russell Hunt[3], Mrs Jodie Grech[4], Mrs Joanne Goodwin[5]
[1]*BloodSafe, Adelaide, Australia,* [2]*BloodSafe, Adelaide, Australia,* [3]*BloodSafe, Adelaide, Australia,* [4]*BloodSafe, Adelaide, Australia,* [5]*BloodSafe, Adelaide, Australia*

Aim: Celebrating the 20-year anniversary of South Australia's BloodSafe Program.

Method: In September 2002 at HAA Adelaide (now BLOOD), a team of enthusiastic, dedicated, and innovative individuals came together to pilot a quality assurance program for blood products in South Australian Hospitals.

It was a collaborative project between the Department of Human Services (now Department of Health and Wellbeing), Australian Red Cross Blood Service (now Lifeblood), Institute of Medical, and Veterinary Science (now SA Pathology) and the Metropolitan and Country Clinical Sub Committees of the SA Hospital Safety and Quality Council (now Rural Support Services).

The names may have all changed but the collaboration is still strong 20 years later with many of the founding members/contributors still actively involved.

Results: The pilot has become part of the suite of programs within the Department of Health and Wellbeing's division of Blood Organ and Tissue Programs directed by Susan Ireland. The BloodSafe mission to coordinate a safety and quality framework for all steps of blood transfusion practice to improve patient outcomes and ensure sufficiency of blood supply by supporting and using patient blood management principles continues.

The Clinical Medical Lead Dr Kathryn Robinson OAM has led the team since 2002. There is currently a BloodSafe Nurse in each metropolitan health network (Southern, Central, Northern, Women's & Children's) along with a private hospital and a regional support nurse.

A few BloodSafe highlights include:

- Collaboration with Australian and international transfusion groups
- Flippin' Blood
- the first prototype of an eLearning, to eventually become BloodSafe eLearning Australia
- Iron prescribing resources
- Patient information resources (translated into 18 languages)
- Initiation of a Private Nurse role
- Blood Link Nurse framework development

Conclusion: BloodSafe looks forward to the continued collaboration with our dedicated and innovative colleagues across Australia and the world.

The double independent bedside check–Development of a how-to video for a healthcare service implementing electronic medical records

Mrs Amanda Catherwood[1], Mrs Joanne Goodwin[2]

[1]BloodSafe, Adelaide, Australia, [2]BloodSafe, Adelaide, Australia

Aim: The final 'bedside' check of pack and patient details is vital to ensure the *right* blood is given to the *right* patient[1]. In 2019, ANZSBT provided clarification, the transfusion double independent (DI) check is 2 professionals *independently* carrying out and taking responsibility for the procedure[1] rather than the historical process of a shared check between 2 staff.

Our health service commenced staged implementation of a statewide electronic medical record (EMR) resulting in significant changes to transfusion workflows. The final hospital went 'live' in March 2020; a week into Australia's COVID-19 pandemic lockdown.

The combined effect of changed workflows and timing, led to unsafe workarounds for critical processes. A hospital bedside check audit confirmed this.

BloodSafe aimed to develop a resource, which was accessible, consistent, repeatable, and engaging, which could reach large groups quickly to improve patient safety during uncertain times.

Method: BloodSafe produced a 5-min video, simulating a patient focused, safe process of a DI check using EMR, to ensure risk mitigation in a timely manner. The video was promoted via the BloodSafe intranet page, education portal and organisational wide communications.

A follow up audit of bedside practice will occur when pandemic and hospital acuity permits. In the interim, a survey was conducted to gain insight into the impact the video had for clinicians and their practice.

Results: As of April 2022, the video gained over 4500 impressions and 604 views. 40 staff responded via Survey Monkey: Of note, 85% confirmed watching the video had changed their practice.

Conclusion: Utilising methods such as video demonstrations provides a platform for quick delivery of accessible, consistent, repeatable, concise, and impactful resources to large groups.

The video is now a statewide resource for Sunrise EMR training and can serve as a 'template' for health services using other EMRs to develop their own resource.

Reference

1. ANZSBT Guidelines for the Administration of Blood Products, 3rd Edition, 2019, Australian & New Zealand Society of Blood Transfusion

Variation in use of immunoglobulin (Ig) and impact on survival in multiple myeloma: A report from the Australia/New Zealand (ANZ) and Asia-Pacific (APAC) myeloma and related diseases registries (MRDR)

Dr Khai Li Chai[1], Cameron Wellard[1], Naomi Aoki[1], Elizabeth M Moore[1], Bradley Augustson[2], Akshay Bapat[3], Hilary Anne Blacklock[4], Wee Joo Chng[5], Rachel Cooke[6], Cecily Forsyth[7], Yeow Tee Goh[24], Nada Hamad[8,9,10], Simon J Harrison[11], Phoebe Joy Ho[12], Jay Hocking[13], Ian H Kerridge[14], Jin Seok Kim[15], Kihyun Kim[16], Tracy King[12], Georgia J McCaughan[8,9], Peter Mollee[17], C Orla Morrissey[18], Nicholas Murphy[3], Hang Quach[19,20], Xuan Ni Tan[2], Allison Tso[21], Kimberly Wong[13], Sung-Soo Yoon[25], Andrew Spencer[22], Erica M Wood[1,23], Zoe K McQuilten[1,23]

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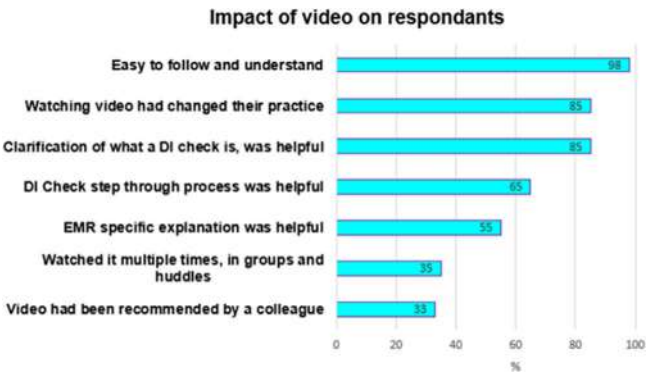

Health, Melbourne, Australia, [24]Department of Haematology, Singapore General Hospital, Singapore, [25]Division of Hematology/Medical Oncology, Seoul National University Hospital, Seoul, South Korea

Aim: To evaluate Ig use in patients with MM in the "real-world" setting, identify variation in practice and predictors of use, and describe association with survival.

Method: Retrospective review of patients with a diagnosis of MM/plasma cell leukaemia registered on the ANZ and APAC MRDR from sites with complete Ig data. Survival and cause of death (COD) was augmented via linkage with death registries for ANZ patients. Patient/disease characteristics, therapy, and survival were compared between patients who received Ig by 24 months (m) of diagnosis or did not, using chi-square tests for categorical variables and rank sum tests for continuous variables. Kaplan–Meier survival analysis was used to estimate duration of Ig use. Time-dependent Cox analysis was used to compare survival for patients whilst on and off Ig. Statistical analysis performed using STATAv16.1.

Results: 2445 patients from 19 sites in four countries (Australia, Korea, NZ, Singapore) with a median follow-up of 30 m were included. Of patients reaching 24 m follow-up, 7.0% received Ig (0%–17% between countries). 69% of these Ig-users were estimated to receive >24 m duration of Ig. Patients who received Ig by 24 m of MM-diagnosis were younger, had lower baseline IgG levels, more likely to have abnormal FISH, receive first-line IMiDs, anti-CD38 and ASCT (Table 1). Ig use was not associated with OS (HR = 0.72, 0.46–1.14, $p = 0.16$). At last follow-up, there were 623 deaths (25.4%). COD was available for 175 deaths–65 deaths (37.1%) had infection as primary/secondary COD. 64 infection-related deaths occurred in patients who did not receive Ig. In patients who received Ig, 12.5% had infection-related COD, compared to 38.5% in non-recipients ($p = 0.14$).

Conclusion: Ig use varied between countries and was associated with first-line IMiD/anti-CD38/ASCT. There is a clear need for contemporary studies to better inform patient selection, especially with rising use of Ig, targeted anti-myeloma therapies and high burden of infection-related mortality.

Interleukin-10 and DNase treatment both mitigate endothelial cytotoxicity in a two-hit model of soluble CD40 ligand mediated TRALI

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Aim: Despite the introduction of risk reduction strategies, transfusion-related acute lung injury (TRALI) remains a significant cause of transfusion-related morbidity and mortality. In the absence of specific treatments for TRALI, patients are supported with supplemental oxygen and in some cases mechanical ventilation. Potential specific treatments, including interleukin (IL) 10 and DNase have successfully prevented or treated experimental TRALI in mouse models; however, their potential to treat clinical TRALI in humans is unknown. We aimed to use an established human in vitro model to assess whether either IL-10 or DNase could mitigate soluble CD40 ligand (sCD40L)-mediated TRALI.

Method: Human microvascular lung endothelial cells (HLMVECs) were cultured ±2 μg/mL *E. coli* lipopolysaccharide (LPS) for 6 h. Isolated neutrophils were added to appropriate wells (1:10 neutrophil: HLMVEC ratio). HLMVECs ± neutrophils were either left untreated or treated with sCD40L (10 ng/mL) for 30 min ± interventions (IL-10 (10 ng/mL) or DNase (1 U/mL)). After trypan blue staining, 3–5 fields

Table 1 Patient demographics, disease characteristics, and upfront treatment, by Ig use at 24 months

Characteristics: median (IQR) or percentage (%)	No Ig within 24 months (1031 patients)	Ig within 24 months (209 patients)	*p*-value
Age at diagnosis	65.3 (58.0, 72.6)	62.6 (55.6, 69.5)	0.01
Female gender	411/1031 (39.9%)	86/209 (41.1%)	0.73
ECOG 2–4	102/674 (15.1%)	20/159 (12.6%)	0.41
Abnormal FISH results	399/610 (65.4%)	96/121 (79.3%)	0.003
ISS-3	230/802 (28.7%)	45/172 (26.2%)	0.51
Serum Ig levels (excluding paraprotein) (g/L)	23.0 (19.0, 40.0)	20.4 (16.6, 24.6)	0.006
Serum IgA levels (excluding paraprotein) (g/L)	0.5 (0.28, 1.1)	0.41 (0.2, 1.1)	0.42
Serum IgM levels (excluding paraprotein) (g/L)	0.2 (0.2, 0.4)	0.20 (0.1, 0.4)	0.11
Serum IgG levels (excluding paraprotein) (g/L)	6.0 (4.0, 10.3)	5.20 (3.3, 7.2)	0.002
First-line treatment with ASCT	550/1031 (53.3%)	124/182 (68.1%)	<0.001
First-line treatment with Proteosome inhibitor	883/1016 (86.9%)	187/206 (90.8%)	0.13
First-line treatment with IMiDs	196/1016 (19.3%)	92/206 (44.7%)	<0.001
First-line treatment with Anti-CD38 therapy	17/1016 (1.7%)	8/206 (3.9%)	0.041
First-line regimen containing Dexamethasone	952/1016 (93.7%)	197/206 (95.6%)	0.29

per well were acquired and viable HLMVECs were identified by ImageJ analysis. Data were analysed with repeated measures one-way analysis of variance (ANOVA) followed by Tukey's post hoc test. $p < 0.05$ was considered significant.

Results: Both LPS and neutrophils were required for sCD40L-mediated HLMVEC cytotoxicity (LPS-control: 81.96% ± 2.65% viability and LPS + sCD40L: 52.68% ± 6.39% viability, $p = 0.005$), confirming the two-hit neutrophil activation pathway. HLMVEC cytotoxicity was reduced by the addition of either IL-10 or DNase (LPS + sCD40L + IL-10: 73.91% ± 4.87% viability, $p = 0.003$ vs. LPS + sCD40L and $p = 0.34$ vs. LPS-control; LPS + sCD40L +- DNase: 73.11% ± 5.64% viability, $p = 0.314$ vs. LPS-control; $p = 0.0003$ vs. LPS + sCD40L).

Conclusion: In this human in vitro model, sCD40L induced HLMVEC cytotoxicity via a two-hit neutrophil activation pathway of TRALI. Both IL-10 and DNase treatment mitigated the sCD40L-mediated HLMVEC cytotoxicity, confirming the importance of further research into their potential as specific treatments for clinical TRALI.

Evaluation of packed and washed RBC for immunomodulatory potential

Ms Fenny Chong[1], Mrs Kelly Rooks[1], Ms Thu Tran[1], Dr John-Paul Tung[1,2,3,4], Dr Melinda Dean[1,2,5]

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Aim: Our understanding of transfusion-related immunomodulation (TRIM) and its possible association with higher rates of poor patient outcomes after transfusion remain limited. We previously demonstrated that mediators in packed red blood cells (PRBC) augmented lipopolysaccharide (LPS)-induced interleukin (IL)-1β inflammation in monocytes[1]; however, the contribution of all leucocytes remains unknown. We assessed the effect of PRBC, PRBC-derived mediators and washed (w)RBC on caspase-1/IL-1β inflammation.

Method: PRBC ($n = 12$) were sampled on day (D)2, D21 and D42, with samples centrifuged to prepare supernatant (SN) and washed as per Lifeblood guidelines to produce wRBC. Whole blood from healthy volunteers ($n = 6$) was incubated with PRBC, PRBC-SN or wRBC (2 units each) ± LPS (bacterial infection model; 37°C, 4 h). Culture SN were collected and caspase-1 (ELISA) and IL-1β (cytometric bead array) quantified. Results were analysed by 2-way ANOVA ($p < 0.05$ was significant).

Results: PRBC, PRBC-SN, and wRBC alone did not modulate caspase-1 and IL-1β production compared to the no transfusion control. Interestingly, LPS-mediated caspase-1 production was reduced by co-culture with D21 or D42 PRBC (D21: $p = 0.007$; D42: $p = 0.04$) or PRBC-SN (D21: $p = 0.039$; D42: $p = 0.011$). Similarly, LPS-mediated IL-1β production was reduced by co-culture with D21 or D42 PRBC-SN (D21: $p = 0.008$; D42: $p = 0.005$). In contrast, LPS-mediated IL-1β production was augmented with the addition of D42 wRBC ($p = 0.0362$).

Conclusions: PRBC and PRBC-SN decreased LPS-induced caspase-1 and IL-1β production while wRBC augmented the levels. Mediators that accumulate in PRBC during storage may inhibit IL-1β driven inflammation. Washing of RBC may remove the inhibitors. The results highlight the complexity of TRIM and the importance of further studies into how TRIM develops.

[1]Chong et al, 2022, Soluble mediators in packed red blood cells augment lipopolysaccharide-induced monocyte interleukin-1β production, Vox Sanguinis, 115:562–569.

Guideline for the prophylactic use of *RHD* immunoglobulin in pregnancy care

Ms Sandra Cochrane[1], Ms Donna Cassoni[1], Ms Brooke Porter[1], Ms Natalie Walton[1]

[1]*National Blood Authority, Lyneham, Australia*

Aim: Review and update the 2003 *Guidelines on the Prophylactic Use of Rh D Immunoglobulin (Anti-D) in Obstetrics.*

Method: A multidisciplinary Expert Reference Group (ERG) was established to oversee the Guideline update. A comprehensive search of the literature was conducted in July 2018 by independent commissioned systematic review. An additional search of the literature was conducted in September 2021 to capture any additional research published since the searches in 2018.

The ERG utilised Grading of Recommendations, Assessment, Development, and Evaluation (GRADE)* to determine the certainty of the evidence and the strength and direction of each recommendation. Public consultation was conducted between 20 September and 8 November 2019.

Results: The update resulted in 12 clinical recommendations and 12 consensus-based expert opinion points across four clinical questions:

- non-invasive prenatal testing (NIPT)
- dosage regimen for antenatal prophylaxis
- use of Rh D immunoglobulin in pregnant women with a Body Mass Index (BMI) ≥ 30
- use of GRADE methodology

Standalone flow charts to demonstrate the care pathway for the prophylactic use of Rh D immunoglobulin in pregnancy care with and without NIPT, and resources on the use and timing of pathology testing and the indications and timing for administration of Rh D immunoglobulin were developed.

The Guideline update was published in May 2021 on the NBA website. The updated literature search in September 2021 did not identify any new studies that could change the direction or strength of the recommendations.

Conclusion: The Guideline for the Prophylactic use of Rh D immunoglobulin in pregnancy care provides clinical advice for the health professionals caring for Rh D negative pregnant women. The guideline includes

recommendations on routine antenatal Rh D immunoprophylaxis, sensitising events. Immunoprophylaxis and immunoprophylaxis regarding BMI. The Guideline will be republished in MAGICapp to facilitate efficient updating of recommendations when indicated.

Blood usage, clinical and laboratory systems at three different Australian hospital sites

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Aim: To review and compare Transfusion Medicine systems, clinical and laboratory services at three different Australian hospital sites: Mildura Hospital in rural Victoria, Peel Health Campus in Western Australia- on the border of rural and metropolitan areas, and Fiona Stanley Hospital, WA's largest teaching hospital.
Method: In collaboration with laboratory and clinical staff at each site, current practices were discussed and reviewed. Product availability and requirements at each site, including management of major haemorrhage, surgical, oncological and obstetric activity was recorded. Local protocols and practises as well as national guidelines were viewed and compared. Blood Component Fate from ARCBS/Lifeblood in 2021 was reviewed.
Results: All sites are compliant with the National Blood Authority Standard 7 and Patient Blood Management guidelines. Regular Transfusion Committee Meetings and close liaison with Lifeblood regarding activity and requirements in the different settings are noted. Mildura Base Hospital being a fairly remove 165 bed teaching hospital requires platelets on site, and adequate supplies of emergency O-Group red cells. The major teaching hospital at Fiona Stanley Hospital has extensive laboratory services and blood products including monoclonal and platelet derived specialised clotting factors. Peel Health Campus is a privately operated 206 bed general hospital one hour south of Perth; platelets are not routinely on site. Blood products are rotated in the network to reduce wastage, which is low. Mildura Hospital expired rate of platelets was 32.8% and RBCs 7.1%, both higher that the national average, unlike the FFP discards of 9.5%.
Conclusion: Robust Transfusion Medicine systems are in place at all three sites. Standards from the National Blood Authority, with supply and guidance from Lifeblood and involvement by Transfusion Committees are instituted at all three sites, including management of major haemorrhage and patients on anticoagulants. Individual factors and requirements related to location and size result in certain local practises, with greater discards at the rural site.

Understanding the pathophysiology of the monocyte monolayer assay (MMA): Characterizing the inflammatory response to clinically significant anti-RBC antibodies

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Background and Aim: The MMA is a functional in-vitro assay that uses a combination of cell isolation techniques and microscopy to predict whether an anti-RBC antibody present in a patient would result in a transfusion reaction. Whether an anti-RBC antibody results in a clinically significant reaction is not correlated with anti-RBC titre, a specific IgG subtype or the capacity of an antibody to fix complement. Improvements in utilising the MMA to predict transfusion reactions is limited by our understanding of the biology underpinning the assay. We investigated the role of inflammation and cytokine driven cell communication in the pathophysiology of the MMA.
Methods: Supernatants derived from previously performed MMA at Lifeblood were selected based on their monocyte index (MI%) in the MMA (≥5% considered clinically significant). Fourteen clinically significant (anti-D, anti-Jka), 25 non-clinically significant (anti-C, anti-E, anti-Ge, anti-K, anti-M, anti-P1, anti-Yta) and 22 matched saline controls were chosen for assessment of cytokine production using quantitative multiplexed cytometric bead array (IL-6, IL-12, IL-1α, IL-1β, TNF-α, IFN-α, IFN-γ, IL-4, IL-10, IL-8, MIP-1α, MCP-1, IP-10, ICAM-1). One-way ANOVA with Dunnet's post-test was used to compare cytokine production.
Results: Supernatants derived from MMA performed with clinically significant antibodies had significantly increased levels of MIP-1α ($p < 0.001$), IL-8 ($p < 0.05$), MCP-1 ($p < 0.05$) and TNF-α ($p < 0.001$), that was not evident when the MMA was performed with antibodies that were deemed non clinically significant. These results suggest exposure to clinically significant antibodies results in monocyte activation and a chemokine driven inflammatory response, which recruit additional phagocytic cells to the area facilitating increased RBC clearance.
Conclusions: Our study-demonstrated proof-of-principle that monocytes exposed to RBC opsonized with clinically significant anti-RBC antibodies in the MMA produced a heightened inflammatory response. We plan to broaden the panel of anti-RBC antibodies included in the study in order to identify a signature cytokine signal to improve prediction of transfusion reactions and improve patient safety.

The importance of transfusion laboratory participation in electronic medical record (EMR) implementation

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Aim: To identify transfusion laboratories input during the various phases of EMR implementation and impact on workflow.

Method: A comprehensive survey about EMR development and implementation was sent to 131 health services in 4 Australian jurisdictions. Perspectives from a variety of craft groups involved in blood management/transfusion was sought, including laboratory scientists. Respondents were asked to record their own experience and observations.

Results:

- 111 responses from 59 health services, 20 using an EMR
- 11 health services used the EMR for blood management
- 7 scientists responded from 7/20 health services with an EMR, 6 were present at go-live
- 5 of 6 (83%) scientists were involved in EMR implementation
- 4 (67%) felt their input was valued
- 2 (33%) felt their input was acted upon
- 9 of 11 (82%) health services with blood management in their EMR stated laboratory subject matter experts provided direct influence in crucial safety processes and compliance with National Pathology Accreditation Advisory Council requirements.

Respondents reported the EMR resulted in many positive workflow changes, along with some negative aspects.

Positives	Negatives
Increased visibility of: • specimen requests/ collections ($n = 5$, 71%) • number of outstanding requests ($n = 4$, 57%) • clinical details ($n = 5$, 71%) • contact details ($n = 4$, 57%) • if blood transfused ($n = 3$, 43%)	Decreased ability to • pre-emptively crossmatch prior to order ($n = 3$, 43%) • view when blood was ready for collection ($n = 2$, 29%) Change in terminology ($n = 4$, 57%)

There were mixed reports of impact on overall productivity/workflow management (1 decreased, 2 increased).

Conclusion: Scientists' participation in EMR development is vital to ensure transparent, streamlined, safe, and efficient practice is maintained and integrated into the EMR. Scientists and their laboratory processes were not fully considered into EMR development and implementation, and this may have negative impact on the perceived and actual workflow changes resulting from the EMR.

Production of anti-SARS-CoV-2 hyperimmune globulin from COVID-19 convalescent plasma by novel tangential flow electrophoresis-based plasma fractionation technology

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Aim: Fractionation methods to purify plasma proteins have produced lifesaving immunoglobulin (Ig) and other plasma derived medicinal products for decades. Known limitations associated with conventional fractionation techniques, including the Cohn-Oncley method, have presented challenges relating to yield, purity and preservation of labile plasma proteins, a finite resource. An innovative tangential flow electrophoresis-based plasma fractionation technology, HaemaFrac®, isolates plasma proteins in one capture step, without use of ethanol or sub-zero temperatures. Here, IgG was purified from pooled convalescent plasma (CP) producing anti-SARS-CoV-2 hyperimmune immunoglobulin (hIVIg) to provide passive immunity in the COVID-19 pandemic.

Method: Pooled CP was fractionated (Aegros Ltd, Sydney) using the novel HaemaFrac® process to produce hIVIg complying with European Pharmacopoeia (EP) for human normal Ig for intravenous administration. Samples were independently analysed. Additional analyses of the pooled CP and hIVIG included total anti-SARS-CoV-2 Spike and Nucleocapsid IgG using the Abbott AdviseDx SARS CoV-2 IgG II and Abbott ARCHITECT SARS CoV-2 IgG assay respectively.

Results: HaemaFrac® produced a highly purified and concentrated anti-SARS-CoV-2 hIVIg meeting EP standards which closely reflected source plasma IgG subclass proportions; IgG_1: 58.9% (59.3%), IgG_2: 33.2% (30.1%), IgG_3: 5.6% (5.7%) and IgG_4: 2.2% (4.9%) (Graph 1). Anti-SARS-CoV-2 spike IgG levels were 21 704 AU/mL and positive for anti-SARS-CoV-2 nucleocapsid with a quantitative index value of 7.36.

Conclusion: Manufacturing hIVIg using the HaemaFrac® technology is feasible and effective, producing a highly purified and potent anti-SARS-CoV-2 hIVIg. Maintenance of physiologic levels of IgG_3 in the hIVIg from CP are encouraging given the important anti-viral effector functions of this IgG subclass. Viral neutralisation activity is yet to be determined. hIVIg may provide therapeutic advantages over CP and monoclonal antibodies. The clinical utility of an anti-SARS-CoV-2 hIVIg as a passive immunity modality is currently being evaluated in a phase 1/2 clinical trial.

Development of an educational package specific to ordering and labeling pathology samples when using sunrise electronic medical record

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Aim: The rollout of Sunrise electronic medical record (EMR) across several SA Health networks along with the integration of a new statewide laboratory information system upgrade resulted in significant changes to clinical workflows for the process of ordering, collecting, and labeling blood samples.

The interface resulted in greater visibility of sample labeling errors, including wrong blood in tube and mismatched sample versus request form, which raised patient safety concerns. It indicated staff were omitting critical steps, such as confirming patient identity and not labeling samples at the bedside. Staff stated they were unaware of new workflows and lacked understanding of the associated risks.

The primary aim was to create an educational package, consisting of a stand-alone animation explaining the steps in an accessible concise platform, plus a more in-depth course containing instructional videos, assessment, and certificate.

Method: A 5-min animation was created using Powtoon, to step through ordering, confirming patient identity and bedside sample labeling when using Sunrise EMR. The animation complements EMR training and will be accessible across the SA Health network.

The course encapsulates risks associated with sample labeling errors, correct workflows, supporting instructional videos and assessment for anyone working with or learning Sunrise EMR.

Results: The course and videos will be finalised and displayed on SA Health Learning platforms by the end of June 2022. A survey will be circulated to assess uptake, learning value and feedback from July.

Conclusion: As more South Australian hospitals go live with Sunrise EMR, this course and instructional videos will be valuable to all new and existing staff and students within SA Health to ensure they understand the importance of confirming patient ID, labeling samples at the patient's side, and preventing incorrect blood products transfused due to wrong blood in tube.

Developing a state-wide blood supply contingency plan in South Australia

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Aim: To develop and document a State-wide Blood Supply Contingency plan (SWBSCP) that aligns with the National Blood Supply Contingency Plan (NBSCP) and local Emergency Blood Management Plans (EBMP) to ensure a coordinated and appropriate response in South Australia to blood or blood product supply emergencies and disruptions.

Method: In South Australia (SA), each Local Health Network (LHN) has its own EBMP, which outlines their roles and responsibilities if the NBSCP were to be activated. We assessed all local EBMPs for currency and alignment with the national plan, as well as for consistency between each other. The NBSCP and local plans were reviewed and evaluated to define the roles and responsibilities of key parties during local or national blood or blood product supply shortages or demand surges. Relevant stakeholders were consulted throughout the development of the plan and include Blood, Organ and Tissue Programs, Department for Health and Wellbeing/Disaster Management Branch, SA Blood Management Council, National Blood Authority, Lifeblood, BloodSafe nurses, hospitals, the state-wide pre-hospital retrieval service, and pathology providers.

Results: A statewide plan has been documented and finalised. The SWBSCP outlines the governance, different phases, and responses to local inventory restrictions placed on ordering capacity, detailed action tables outlining the minimum required actions by stakeholders at each alert level of the NBSCP and the communication workflows and pathways.

The plan recommends that all LHNs update their current EBMPs to align with the National and statewide plan and that pathology providers also develop their own EBMP to ensure consistency of responses across South Australia.

Conclusion: The statewide plan provides defined information about the roles, responsibilities, and communication channels and has been discussed by all key stakeholders. The statewide plan ensures a consistent and appropriate response by South Australia to blood or blood product supply emergencies and disruptions.

Victorian subcutaneous immunoglobulin (SCIg) use in haematology, five years after the introduction of the SCIg access program

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Background: The SCIg Access Program was launched by the Victorian Department of Health in February 2017 following approval of SCIg as a treatment for patients with immunodeficiencies in 2013. Blood Matters subsequently employed a project nurse to support the SCIg Access Program in November 2017.

Benefits of SCIg therapy include stable immunoglobulin (Ig) levels and patient-reported improved quality of life. Eligible patients can choose to self-administer smaller more frequent infusions at home, as opposed to day admissions for intravenous immunoglobulin (IVIg).

Aim: To promote SCIg as a treatment option and choice for all eligible Victorian patients.

Method: The project nurse supports health services to implement and develop SCIg programs and to promote the benefits of SCIg. Assistance is provided to overcome implementation barriers, identifying eligible patients, along with product dispensing logistics. Training, enhanced by tools and resources available on the Blood Matters website, is delivered to patient educators.

Results: The figure below demonstrates the number of dispenses for SCIg eligible patients.

Patients transitioning to SCIg across haematology and immunology have increased, however the main area of use continues to be in immunology. Data highlights the percentage of SCIg uptake from eligible patients in haematology has been lower each year than that of immunology.

Conclusion: While SCIg patient numbers are increasing, further work is required to ensure haematology patients with secondary immunodeficiencies are aware of and have access to this treatment choice.

South East Asia Delegate (Sponsored by the International Society of Blood Transfusion)

The output of quality control of blood components preparation

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Aim: To analyse the results of the quality control of blood components Central Blood Transfusion Service–Indonesian Red Cross.

Method: An Observational cross–sectional study was conducted from January to December 2021. A total of 192 units of each blood components were chosen during the study, Packed Red Cell (PRC) from 350 ml 4 units per month were evaluated for volume (Vol), hematocrit (HCT), hemoglobin (HB) and Hemolysis. Platelet Concentrate (PC) from 350 ml 4 units per month were evaluated for Vol, platelet count, leucocyte content and pH. Fresh Frozen Plasma (FFP) from 350 ml 4 unit per month and from 450 ml 4 unit per month were evaluated for Vol and Factor VIII (FVIII) then take the test results to analyse statistical values with the criteria of National guideline and standard on blood services in Indonesia.

Results: A total of 192 units were tested for quality control. The mean of Vol, HCT, HB and Hemolysis of PRC 350 ml 48 units was 224 ± 10.61 ml, 67% ± 2.89%, 49 ± 4.09 gr/dl and 0,3% ± 0.17%, respectively, the result met the standard 100%. The Mean of Vol, platelet count, leucocyte content and pH of PC 48 units was 61 ± 8.34 ml, 55 ± 7.09 × 10^9/unit, 0.005 ± 0.01 × 10^9/unit and 7.2 ± 0.26, the result meet the standard 100%, 98%, 100% and 100%, respectively. The Mean of Vol and FVIII of FFP 350 ml 48 units 189 ± 17.57 ml and 1.1 ± 0.31 IU/ml. The Mean of Vol and FVIII of FFP 450 ml 48 units 229 ± 31 ml and 1.1 ± 0.3 IU/ml, which met the standard 100% both Vol and FVIII.

Conclusion: From the results, it can be concluded that the quality pf blood components; PRC, PC, and FFP being prepared meets the criteria of National guideline and standard on blood services in Indonesia.

South East Asia Delegate (Sponsored by the International Society of Blood Transfusion)

Description of characteristics of blood transfusion patients with incompatible crossmatching test results in the Bekasi Regency Blood Center of Indonesian Red Cross

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Aim: This study aimed to describe the characteristics of blood transfusion patients with incompatible crossmatching test results in the Bekasi Regency Blood Centre of Indonesian Red Cross period January – May 2021.

Method: This study was carried out collecting data from January – May 2021. Data was collected retrospectively from crossmatching testing form of the Bekasi Regency Blood Centre of Indonesian Red Cross.

Results: From the results of data collection carried out at the Bekasi Regency Blood Centre of Indonesian Red Cross as many 168 samples of patients who carried out a crossmatching test with incompatibility results in January – May 2021 the most results based on the type of incompatibility were major negative and auto control positive as many as 101 samples (60%), auto control positive and major positive as many as 37 samples (22%), auto control positive as many as 22 samples (13%), auto control positive and major negative as many as 8 samples (5%). Based on gender there were female as many as 94 samples (56%) and male as many as 74 samples (44%). Based on blood type there were blood type O as many as 59 samples (35%), blood type B as many as 49 samples (29%), blood type A as many as 46 samples (27%) and blood type AB as many as 14 samples (8%).

Conclusion: This study is based on incompatible crossmatching test results in the Bekasi Regency Blood Centre of Indonesian Red Cross period January – May 2021 with the highest number of incompatibilty types is major negative and auto control positive, female gender and blood type O.

South East Asia Delegate (Sponsored by the International Society of Blood Transfusion)

Seroprevalence of HBV, HCV, HIV and syphilis in blood donors during 2017–2020 at blood center Indonesian Red Cross

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Aim: This study aimed to determine the seroprevalence of HBV, HCV, HIV, and syphilis infections among blood donors from 2017 to 2020 at the National Blood Centre Indonesian Red Cross.

Method: A retrospective study was designed to analyse data collected from the all laboratory blood centres in Indonesia during 2017–2020.

Results: The total number of 3 200 276 units from blood donating in 2017 prevalence of all infectious markers were 32 260 units (1.01%). HBV 15.383 units was analysed 0.48%. Syphilis 8509 units was analysed 0.27%. HCV 5231 units was analysed 0.16%. HIV 3137 units was analysed 0.10%. The total number of 3 410 880 units from blood donating in 2018 prevalence of all infectious markers were 34 459 units (1.01%). HBV 14974 units was analysed 0.44%. Syphilis 8655 units was analysed 0.25%. HCV 6230 units was analysed 0.18%. HIV 4600 units was analysed 0.13%. The total number of 3 523 982 units from blood donating in 2019 prevalence of all infectious markers were 32 849 units (0.93%). HBV 14443 units was analysed 0.41%. Syphilis 8071 units was analysed 0.23%. HCV 5782 units was analysed 0.16%. HIV 4553 units was analysed 0.13%. The total number of 2 990 252 units from blood donating in 2020 prevalence of all infectious markers were 29 974 units (1.00%). HBV 12954 units was analysed 0.43%. Syphilis 7491 units was analysed 0.25%. HCV 5361 units was analysed 0.18%. HIV 4168 units was analysed 0.14%.

Conclusion: This study shows that the highest seroprevalence of HBV infections, the second highest seroprevalence of Syphilis infections, the third highest seroprevalence of HCV infections and lowest seroprevalence of HIV infections in all Blood Centre Indonesian Red Cross.

Neonatal alloimmune thrombocytopenia (NAIT) is uncommon, but still important: Patient characteristics, management and outcomes from the Australian NAIT registry

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Aim: NAIT is an uncommon but important cause of profound thrombocytopenia leading to severe haemorrhage in the fetus/neonate. We analysed data from the Australian NAIT registry to describe current treatment and outcomes for NAIT.

Method: All cases registered from 2009 to 2021 were included, defined as:

Pregnant women treated antenatally for NAIT, regardless of laboratory results.

Fetus/newborn with thrombocytopenia, bleeding and maternal HPA antibodies.

Results: Case analysis at 27 of 30 Australian sites identified 117 mothers with 134 pregnancies and 139 babies (5 sets of twins). 21% were first time mothers with a median age of 30.5 years.

NAIT was not anticipated in 62% of pregnancies. These neonates had lower platelet counts, required more platelet transfusions, and greater incidence of bleeding (petechiae, purpura, GI, pulmonary, intracranial [ICH] or other) than in anticipated cases. 12 ICHs were reported (8.6% of babies), and 7 neonates made a complete recovery.

Maternal antibodies were identified in 86% of cases, 18% of which were HLA only. Of the HPA antibodies, 66% were anti-HPA-1a, 8% anti-HPA-5b. 90% of anticipated cases were treated with antenatal IVIg, with a total of 47 325 g transfused.

68 neonates received 151 platelet transfusions; of these 24% were HPA matched. Median [IQR] pre-transfusion platelet count where bleeding recorded ($N = 59$) was 13×10^9/L [6, 21] and 17×10^9/L [7, 36] in cases where no bleeding recorded ($N = 14$). Pre-transfusion platelet count was >25 $\times$ 10^9/L in 36% (5/14) of platelet transfusions in neonates with no bleeding and 14% (8/57) in neonates with bleeding.

Conclusion: The majority of NAIT cases are unexpected, with higher rate of bleeding complications and requirements for neonatal treatment. Platelet transfusion thresholds varied, which likely reflects the lack of data to inform practice in this patient population. Future research should focus on long-term outcomes as well as costs, to inform policy and practice.

	Not anticipated	Anticipated
Pregnancies	82	51
Neonates	84	55
Maternal antenatal IVIg	0/82	43/48 (3 cases no data)
Neonatal Platelet Counts ($\times 10^9$/L) (median, IQR)		
First	21 [10, 38]	142 [72, 229]
Lowest	16 [7, 29]	110 [38, 200]
Neonatal Platelet transfusion	59/79 (75%)	12/46 (26%)

Using point-of-care devices for identifying sickle cell trait (HbAS) in blood donors whose donations result in recurrent leucodepletion failure during red blood cell manufacture

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Aim: Recurrent leucodepletion failure can occur during red blood cell (RBC) manufacture. Failure of leucodepletion impacts RBC quality and usually results in product discard. The authors have previously demonstrated that 40% of Australian donors with recurrent leucodepletion failure have Sickle Cell trait (HbAS). HbAS donors have been detected using variable methods internationally. In Australia, the Sentrix® BeadChip genotyping system has been formally validated; however, it is costly to perform.

More recently, a lateral flow-based point-of-care assay (Sickle SCAN®) has been developed and validated for the detection of HbS, HbC and HbA. It is also validated for samples collected and stored in EDTA. Our study aimed to analyse the use of Sickle SCAN® in supporting the management of donors with recurrent leucodepletion filter blockage after whole blood donation.

Method: Between 29 May 2021 to 3 May 2022, donations where the filter block processing code was used were identified in the National Blood Management System managed by Australian Red Cross Lifeblood. Residual samples from the EDTA mandatory testing tubes from these donations were obtained and tested on the Sickle SCAN® test as per manufacturer's instructions. Samples were also tested via Haemoglobin electrophoresis (Hb EPG) and HPLC for confirmation.

Results: Twenty-nine donations from blood donors with at least 2 recurrent filter-blocking instances were analysed. It was found that 11 (38%) were HbAS donors and 17 (59%) were HbA and one donor needed further investigation. All Sickle SCAN® results were confirmed by Hb EPG and HPLC.

Conclusion: The Sickle SCAN® test could be used to support the management of donors with recurrent RBC leucodepletion filter blockage after whole blood donation. The test may assist to screen donors whose RBCs are used in high-risk settings such as intrauterine transfusion or after a single episode of leucodepletion failure to prevent repeated processing issues.

The prevalence of transfusion-associated microchimerism in 45 and up study participants

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Aim: Since the introduction of leucocyte filtration in the processing of Australian red blood cell (RBC) units, there has been a reduction of transfusion-related reactions in patients. However, transfusion-associated microchimerism (TAM) is still found to occur in 10% of multiply transfused trauma patients. TAM is a condition where genetically distinct donor leucocytes remain in the transfused patient. Its prevalence across all transfusion recipients and whether older patients are more susceptible is uncertain. What remains unknown, is whether TAM has any long-term health consequences.

Participants in the Sax Institute's 45 and Up Study are part of a longitudinal study who answer health and lifestyle questions and have consented to linkages with other routinely collected health administrative data and registries. There are over 267 000 participants across New South Wales (NSW), which provides a unique opportunity to measure the prevalence of TAM in those who have had a RBC transfusion to potentially understand longer-term health consequences.

Method: 45 and Up Study participants who have been transfused with at least one RBC unit were identified from the linked hospitalisation database. Potential participants ($n = 350$) were approached by posted invitational letters. EDTA blood samples for analysis were collected from participants *via* commercial pathology centres and sent to Lifeblood. Genomic DNA (gDNA) was extracted from the buffy coat and typing for a series of insertion/deletion (InDel) polymorphisms will be conducted for TAM detection.

Results: This project has been delayed because of COVID-19 restrictions and the 2022 NSW flooding emergency in March 2022. To date 100 participants have been approached. Of those, 25 individuals (25%) provided blood samples for analysis. The remaining 250 participants are being approached in late May.

Conclusion: Study uptake to date was extremely good from the participants of the 45 and Up Study. Sample analysis paired with long-term health data is unique to this cohort and will allow more understanding of transfusion-related patient outcomes.

How accurate information on national ABO prevalence can assist the health sector

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Aim: During the COVID-19 pandemic it was hypothesised that individuals with certain ABO groups were more susceptible to SARS-CoV-2 infection. Separately, prior to 2020, national data on the ABO Rh(D) prevalence had never been collected despite 30% of Australian residents being born overseas. Having accurate national data to understand ABO Rh(D) prevalence enables supply forecasting for blood and blood products but also assists with emergency health planning, including determining whether there is any correlation between blood group and COVID-19 incidence and severity.

Method: To obtain data from Australian patients across the country, 41 pathology agencies representing 324 approved health providers (AHPs) were approached. Blood donor data was extracted from Australian Red Cross Lifeblood's National Blood Management System. ABO Rh(D) data on blood donors enrolled in the COVID-19 convalescent plasma (CP) program in 2020 was also analysed.

Results: Twenty-eight pathology agencies representing 245 AHPs provided information from 1 318 751 patients. This data indicated blood group prevalence was as follows; O+ 38.4%, O- 6.5%, A+ 32.0%, A- 5.6%, B+ 11.8%, B- 1.5%, AB+ 3.7% and AB- 0.5%.

A total of 490 491 individual blood donors which included 103 798 (21.2%) first-time blood donors were also analysed. The prevalence of each blood group in first-time blood donors was similar to that found in patients. When compared with data from 1993 to 1994, the number of Rh(D) + Australians has increased by 4.9% in patients and by 2.8% in first-time blood donors.

The distribution of ABO group in CP donors compared to the total donor panel was not significantly different ($p = 0.177$).

Conclusion: The proportion of Rh(D) + individuals in Australia has increased over the past 25 years and there was no ABO association in CP donors compared to the blood donor panel. This first national dataset provides contemporary community-wide data for health planning and evaluation of blood holdings. It also highlights the challenge of meeting the demand for Rh(D)- red blood cells.

Building a national transfusion dataset for Australia

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Aim: To establish an integrated National Transfusion Dataset (NTD) with links to clinical outcome data.

Method: The NTD builds on the work of the Australian and New Zealand Massive Transfusion Registry (ANZ-MTR) and the pilot Transfusion Database (TD). Data are obtained from prehospital services and participating hospitals for all blood products transfused to patients ≥18 years, not just massive transfusions. Data items include:

demographics, clinical coding (diagnosis, hospital admission), laboratory, transfusion data, and patient outcomes (mortality, clinical response, quality of life).

Where possible, specific patient cohort data (e.g., ICU admission for blood diseases) will be linked with national clinical datasets including:

- ANZICS Adult Patient Database (ANZICS APD)
- Aplastic Anaemia and other Bone Marrow Failure Syndromes Registry (AAR)
- Lymphoma and Related Diseases Registry (LaRDR)
- Myeloma and Related Diseases Registry (MRDR)

Monash University in collaboration with subject-specialist clinicians and researchers performs data management (aligning with FAIR principles) involving harmonisation, integration, linkage, and analysis. The Australian Research Data Commons supports the project.

Results: Initial data from Ambulance Victoria and pilot hospitals (The Alfred, Flinders Medical Centre) have been incorporated into the NTD and analysis has commenced. The first linkage with the AAR has been successfully undertaken, demonstrating feasibility, and the high volume and complexity of transfusion support for this patient group. Additional sites (hospitals and prehospital services) are in preparation. Plans are in place to expand the NTD with CogStack, a natural language processing platform to incorporate unstructured data from patient medical notes (such as administration, and adverse event reports) into the NTD, and to link with haemovigilance data.

Conclusion: The NTD is underway, and will deliver a complete picture of transfusion practice from donor to product to patient, provide evidence on blood use to support evidence-based policy decisions, continue to provide information on massive transfusions, and improve blood utilisation and clinical outcomes for Australian patients.

Evaluation of full blood count samples from Lifeblood's blood or plasma donors tested under two conditions of storage and transport

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Aim: Lifeblood completes full blood count samples (FBC) for selected donors to assess their suitability for future donations. Removing the current requirement for storage and transport of these FBC samples at refrigerated temperature and aligning with room temperature storage and transport of other donor blood samples would produce significant efficiencies in blood donor centres. This study aimed to compare the results of donor full blood count samples stored and transported at refrigerated (2–8°C) and room temperature (4–25°C).

Method: A total of 500 full blood count samples were collected from 250 whole blood or plasma donors. These were paired for storage and transport to the processing laboratory at either refrigerated or room temperature. Samples were tested on arrival at the processing center and the following day, after being stored at either refrigerated or room temperature. The primary outcomes of interest included differences between mean cell volume (MCV), haematocrit (HCT), white cell count (WCC), white blood cell differential counts, and the need to produce blood films based on existing criteria.

Results: The results comparing the two storage and transport conditions showed a statistically significant ($p < 0.05$) difference between MCV, HCT, WCC on both day one and two. Blood films were required from 16 donors due to numerical flags of results and 13 donors due to automated analyser morphology flags. The number of films required was similar in each group.

Conclusion: While statistically significant differences were demonstrated between the data sets, the clinical significance of the small numerical differences is considered minimal. Furthermore, the number of blood films required remained similar under either temperature condition. Given the significant reductions in time, processing, and costs associated with room temperature over refrigerated storage and transport, we recommend a further pilot study to monitor the broader impacts, with the intent to implement national transport of FBC samples at room temperature within Lifeblood.

Red cell antibodies: Frequency in the Australian blood donor population

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Aim: Australian Red Cross Lifeblood (Lifeblood) performs red blood cell (RBC) antibody screening on every new blood donor. Red cell antibody screening is a critical step to identifying unexpected non-ABO antibodies in donor plasma. The reactivity of these antibodies can be variable and have the potential to cause haemolytic transfusion reactions (HTR) or shortened red cell survival when transfused.

Method: A retrospective desktop analysis of the red cell antibody screening results was performed on all new blood donors collected by Lifeblood between 1/1/2020 and the 31/12/2021.

Results: Lifeblood registered 201 005 new donors between 2020 and 2021. The presence of red cell antibodies was confirmed by antibody identification panels in 517 donors (0.3%). Red cell antibodies were more likely to be detected in female donors (80%) compared to male donors (20%). The proportion of female donors with red cell antibodies exceeded the overall proportion of new donors that were female. 0.4% of new female donors were antibody positive compared to 0.1% of new male donors.

There were 28 different alloantibody specificities identified, 66 donors had multiple antibodies, and 247 (48%) donors had alloantibodies with Rh specificity. There were 112 (22%) donors with autoantibodies only and a further 2 donors with alloantibodies and an autoantibody.

Previous pregnancy was declared by 326 (79%) of the female donors at donor interview. A history of transfusion was declared by

11, 5 males and 6 females. 5 of the females with a history of transfusion also had a history of pregnancy.

Conclusion: Antibodies in blood donors are more likely due to pregnancy or acute transfusion rather than transfusion due to a chronic illness. This cohort would be reflective of an otherwise healthy population. The frequency and range of antibodies in this cohort may assist in understanding the risk of transfusion reaction in emergency setting for patients that do not have a history of chronic transfusion.

COVID-19 and blood transfusion–minimising blood wastage

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Aim: To develop a plan directed towards minimising blood wastage and ensuring appropriate blood handling during COVID-19 pandemic.

Method: The frequency of blood donation in Australia declined dramatically due to escalating COVID-19 cases, recurring lock downs and staff shortages. To decrease risk of infection of blood units delivered to potential COVID-19 infectious (red zone) areas, and to minimise wastage, key stakeholders from Transfusion Medicine, infection control, anaesthesia, intensive care, emergency, haematology, orderlies, RFDS, Emergency Helicopter Retrieval were consulted for blood management best practice. The plan included development of a staff education poster for use during teaching huddles, and labeling of blood shippers within hospital as well as disposable outer packaging of shippers for intersite transport. The poster was distributed by hospital global message, on Health Information Hubs and to external blood users. COVID-19 blood wastage was recorded on the Laboratory Information System and monitored for trends to determine if further education was required.

Results: Despite a great deal of information being readily available with regards to COVID-19 regulations, this was not the case for blood product management. Hence, it was vital to develop an education plan.

To date, blood wastage due to potential COVID-19 infection has been limited to Albumex 4% and 20% = 6 vials, IVIG = 2 vials, RBC =3 and plasma =2.

Conclusion: The insufficiency of comprehensive blood product management information for COVID-19 patients lead to the development of a well-structured poster on this topic. The availability of the education poster and roll out plan was key to success to inform all staff of their duty to manage blood judiciously to minimise waste and ensure safety of all patients. The result is minimised blood wastage in a large tertiary hospital during this pandemic. The poster was shared to West Australian Transfusion Education group.

A 5-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 option (AP) as a part 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 reviewed how well the participants performed phenotyping on red blood cells using serological methods.

Materials and Methods: A total of 20 whole blood samples (4 per year per site) suspended in a red cell preservative were provided to an average of 204 laboratories enrolled for the AP program over a 5-year period (2017–2021).

Participants were asked to perform extended red cell phenotyping on the sample.

The returned results were analysed using in-house statistical software.

Results: Over the 5 years, we noted an increasing number of survey participants and improved overall performance in confirming the presence or absence of red cell antigens; however, there are areas requiring improvement. These included the need for more comprehensive antigen typing to be routinely performed in every blood bank. While all sites performed the basic phenotyping, a number were referring when they should consider implementing in-house.

Conclusion: This retrospective study determined that while most participating laboratories performed red cell phenotyping competently, a number where referring the less common phenotypes which could present a risk to their patients. We recommend that all transfusion laboratories should have access to comprehensive phenotyping antisera.

Haemolytic disease of the fetus and newborn caused by a novel RhAG antigen with c.140T>C (p.Phe47Ser) missense mutation

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Aim and background: The Rh-associated glycoprotein (*RHAG*) forms a core part of the Rh complex and is essential for the expression of RhD and RhCE antigens on red blood cells (RBCs). Several molecular mutations of the *RHAG* gene have been reported to result in a severe reduction (Rh_{mod}) or complete absence (regulator Rh_{null}) of Rh antigens. Here we describe a case of haemolytic disease of the fetus and newborn (HDFN) caused by an antibody to a novel low frequency *RHAG* antigen.

Clinical presentation: A baby born in Thailand presented with HDFN (cord blood direct antiglobulin test 4+, hemoglobin 15.3 g/dL with jaundice and hyperbilirubinemia). The maternal antibody was reactive with RBCs of the father and older sibling. Extensive antibody investigations revealed no apparent specificity.

Method: Blood samples of the infant and family members (n = 3) were collected and sent to the Red Cell Reference Laboratory.

Phenotyping was performed by standard serological methods. Genomic DNA was extracted from the red cells and genotyped using the Immucor BioArray HEA Precise BeadChip kit. DNA sequencing was performed using the Custom Targeted Sequencing Panel.

Results: The patient's predicted phenotype was C+, E-, c-, e+, K-, Fy(a + b-), Jk(a + b+), M+, N-, S-, s+. Weakened Rh antigen expression was demonstrated by RBCs of the older sibling. Sequencing revealed that the infant, father and older sibling were heterozygous for a novel variant, c.140T>C (p.Phe47Ser), of the *RHAG* gene. The low frequency *GYPB*23* allele (s^D+ phenotype) was also detected in both children and the mother.

Conclusion: The presence of a novel *RHAG* c.140T>C variant at the heterozygous level results in a low frequency antigen and was responsible for this case of HDFN observed. Serological findings suggest that this variant affects the expression of RhD and RhCE antigens.

Thinking outside the blood bank: How incorporating fibrinogen concentrate and the use of thromboelastography into the critical bleeding protocol reduced a paediatric hospitals cryoprecipitate waste

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Aim: To determine if the implementation of storing Fibrinogen Concentrate and use of thromboelastography in Theater and adding to Critical Bleeding Protocol at a tertiary paediatric hospital led to a reduction in Cryoprecipitate waste.

Method: Before Fibrinogen Concentrate was made available at the hospital, Cryoprecipitate was the blood product of choice to treat low fibrinogen during a critical bleed. Wastage of Cryoprecipitate at site was high.

The local Blood Management Committee trialled the use of Fibrinogen Concentrate and thromboelastography in August 2020, and their use was incorporated into the Critical Bleeding Protocol from November 2020. Data was extracted from the Laboratory Information system (LIS) to determine cryoprecipitate use and wastage, and the Theater Automatic Drug Machine (ADM) for Fibrinogen Concentrate use.

Results: Between June 2018 and November 2020, there were 995 units of Cryoprecipitate issued to the hospital, with 15 (1.5%) incidents of Cryoprecipitate waste. Since November 2020 when the Fibrinogen Concentrate was made available, there has been 10 units of Cryoprecipitate wasted (1.5%) from 647 units issued. Since its introduction, 76 vials of Fibrinogen Concentrate have been used.

Conclusion: While the incidence of Cryoprecipitate wastage has remained stable (1.5%) since the introduction of Fibrinogen Concentrate and thromboelastography to the hospitals critical bleeding protocol, cryoprecipitate use has reduced by approximately 30%. Blood waste and Fibrinogen Concentrate use continue to be monitored and reviewed by the hospitals Blood Management Committee to ensure safe and appropriate practice.

Is change always safer? A review of paediatric platelet transfusion reactions post introduction of platelet additive solution (PAS) in apheresis platelets

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Background: In March 2019, the Australian Red Cross Lifeblood introduced Apheresis Platelets in Platelet Additive Solution (PAS); prior to this Apheresis Platelets were suspended in 100% donor plasma. The introduction of PAS, which contains less plasma, was thought to reduce the incidence of allergic and other transfusion reactions.

Aim: To assess the clinical safety profile of Apheresis Platelets in PAS at a tertiary paediatric hospital.

Method: A comprehensive retrospective review of transfusion reaction information was reviewed from the commissioning of the new paediatric hospital from June 2018 to February 2022. Data were extracted from Haemovigilance spreadsheets and the Laboratory Information System (LIS). Data collected included Platelet product characteristics and type of reaction. Imputability score and severity of the transfusion reactions were determined by state and national Haemovigilance reporting guidelines.

Results: During the study period, approximately 3875 platelets were transfused of which 3867 were Apheresis Platelets. There were 23 Platelet related transfusion reactions reported. Apheresis Platelets accounted for 96% (22) of the platelet reactions, with only 1 Pooled Platelet reaction reported.

Prior to the introduction of Apheresis Platelets in PAS there were nine reactions reported with 67% classified as allergic reactions and 33% classified as anaphylactoid/ anaphylactic reactions. Imputability scores were no morbidity 1, Minor 3, Severe 4, Life threatening 1. Following the introduction of Apheresis Platelets in PAS 14 reactions were reported with 71% classified as allergic and 29% anaphylactoid/ anaphylactic. Imputability scores were minor morbidity 10, Severe and life threatening 4.

Conclusion: This review suggests an increase in the incidence of reported transfusion reactions after the introduction of Apheresis Platelets in PAS. However, there did appear to be a reduction in the severity of the transfusion reactions after the product change. The increase in reported reactions could be related to implementation of a transfusion nurse leading to improved reporting avenues within the hospital.

A comprehensive critical bleeding protocol (CBP) record developed to facilitate better staff communication and improve patient outcomes in critical bleeding scenarios

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Aim: Timely and accurate communication between clinical and laboratory staff is essential in critical bleeding situations. Miscommunication

can result in less blood products arriving than initially anticipated, plus confusion as to when further products will be made available. Consequently, a detailed CBP Record was designed to improve communication between staff and provide a standardised process for the safe and rapid ordering of blood products.

Method: A new role was developed to facilitate better communication in critical bleeding situations. This role is the Emergency Transfusion Coordinator, who is also the scribe completing the CBP Record. The record was developed in accordance with national Patient Blood Management guidelines in one hospital in Perth, Western Australia. This record includes a top section to write down relevant names and contact numbers, followed by three actions. The first action instructs the scribe to activate the Critical Bleeding Protocol and order blood products guided by blood tests or rotational thromboelastometry (ROTEM). The second action allows the scribe to track blood product usage contemporaneously ensuring blood products are available in a timely manner. The final action lists the body temperature and blood test results clinicians need to normalise to reverse coagulopathy and stabilise the patient. The reverse side of the CBP Record includes space to record cell saver details, as well as a pathology communication log. The CBP Record was piloted within the Theater and Emergency Departments in 2014.

Results: The CBP Record was widely appreciated by all theater and emergency staff. Communication between clinical and laboratory staff improved significantly, resulting in targeted management of the bleeding patient with better outcomes.

Conclusion: The CBP Record proved to be an effective tool in improving communication between staff in critical bleeding scenarios, as well as providing a comprehensive overview of the blood products and tests involved in the management of critically bleeding patients.

It takes a "village" to raise the standard of care

Ms Susan Ogley[1], Mrs Kobie von Wielligh[1], Mr David Peterson[1], Mrs Louise English[1], Mrs Emma McGrath[1], Mrs Trudi Verrall[1]

[1]*BloodSafe eLearning Australia, Adelaide, Australia*

Background: BloodSafe eLearning Australia (BEA) has over 40 courses on patient blood management and safe transfusion practice, and additional videos, podcasts, and tools. There are more than 750 000 registered learners who have completed over 1.5 million courses. This would not be possible without a large community of reviewers, expert advisors, and video interviewees. This presentation celebrates those healthcare professionals who willingly give up their time to assist in the ongoing success of this award-winning national program.

Method: An analysis of the BEA reviewer database was performed to identify different professions and specialties. Course evaluations for the last six months were also analysed, regarding impact on clinical practice, prevention of adverse events and effect on patient outcomes.

Results: Specialties covered:

- Transfusion
- Cardiology
- Neurology
- Renal
- Neonatology
- Paediatrics
- Haematology
- Oncology
- Neurosurgery
- Gastroenterology
- Obstetrics
- Gynaecology
- Critical Care
- Orthopaedic surgery
- Anaesthesia
- Immunology
- Cardiothoracic surgery
- Vascular surgery
- Emergency medicine
- Academia
- Research
- Pharmacy
- Dietetics
- Governance
- Administration
- Consumers

To date BEA has engaged approximately 280 experts from a wide variety of clinical and professional backgrounds including.

- Medical specialists: 198
- Nursing: 58
- Midwifery: 15
- Other: 11

Additionally, more than 100 video interviews have been undertaken for video content within the courses.

Course evaluation surveys show that respondents believe there will be an improvement in patient outcomes and reduction in near-miss events. For the period November 2021 to May 2022 there were 411 responses, with:

- 90% reporting that the BEA courses have helped them identify near misses and prevent adverse events
- 93% stating that BEA courses improve patient safety and outcomes, and
- 72% stating that they would change their practice.

Conclusion: These demonstrate the value of a large community of professionals who willingly provide their time to improve patient safety and outcomes through education.

Prevalence of anaemia in cardiac surgery patients and the effect on intra-operative and post-surgery transfusion practice

Prof David Roxby[1], Dr Tina Noutsos, Dr Romi Sinha, Prof Rob Baker
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Aim: Evidence suggest that a significant gap exists between the release and adoption of patient blood management guidelines. The aim of the study is to examine the prevalence of preoperative anaemia and anaemia on hospital discharge in patients undergoing cardiac surgery including the incidence of transfusion of blood and blood products intraoperatively and postoperatively in the Intensive Care Unit.

Method: Data were retrospectively collected for all consecutive patients who underwent cardiac surgery at a tertiary hospital between January 2014 and June 2019. Data collection included patient demographics, cardiac surgery type, blood and products transfused and haemoglobin levels.

Results: There were 2339 cardiac surgery admissions, including 1178 cardiac artery bypass graft, 1029 cardiac valve and 132 other surgeries included during the study period. Intraoperatively, 8.2% (192/2339) admissions received red cells, 2.7% (62/2339) fresh frozen plasma (FFP), 8.6% (200/2339) platelets and 1.8% (42/2339) cryoprecipitate. In ICU, 27.3% (638/2339) admissions received red cells, 12% (318/2339) FFP, 3.6% (318/2339) platelets and 4.6% (107/2339) cryoprecipitate. 732/2339 (31.3%) admissions were anaemic pre-surgery and 1139/2130 (53.5%) had a haemoglobin <100 g/L at hospital discharge. There was a significant difference in the median, interquartile (IQR) haemoglobin levels prior to surgery (142 [132–151] vs. 115 [102–123], $p < 0.001$), nadir haemoglobin intraoperatively (98 [89–106] vs. 76 [70–86], $p < 0.001$), and during ICU stay (95 [82–106] vs. 79 [72–88], $p < 0.001$), and on discharge (100 [92–111] vs. 94 [86–102], $p < 0.001$), from hospital between non-anaemic and anaemic admissions respectively (Figure 1). Anaemic patients at admission had significantly higher red cell transfusions intraoperatively (20.8% vs. 2.5%, $p < 0.001$) and in ICU (43.6% vs. 19.8%, $p < 0.001$). Overall in-hospital mortality was 1.3%.

Conclusion: Preoperative anaemia was present in 31% of cases and significant anaemia was prevalent at hospital discharge. Addressing causes of pre-admission anaemia may assist in reducing transfusion requirements and preventing significant anaemia at discharge.

iTEM, a mobile application-based thromboelastometry (ROTEM) educational and interpretation tool

Prof David Roxby[1], Dr Romi Sinha
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Aim: Thromboelastometry (ROTEM) is a functional whole blood viscoelastic assay that provides dynamic global assessment of the coagulation process. ROTEM has been implemented in many centres in Australia and internationally to monitor haemostasis in critical bleeding patients and guide appropriate blood product replacement. Being a dynamic test it requires competency in interpreting the traces for all the assays and understanding the relevant haemostatic defect and their clinical implications.

Method: A mobile application was developed to assist with clinical interpretation and education of health professionals using ROTEM in management of bleeding patients.

Results: The Interpreting TEM (iTEM) App has two modules–a Training and Education Module and an Interactive Interpretation Module. The Training Module has several sections including the ROTEM Assay section that briefly explains the various assays including EXTEM, INTEM, FIBTEM, HEPTEM and APTEM and their use in assessment of haemostatic disorders. The ROTEM Parameters section describes several different ROTEM parameters including the significance of Clotting Time (CT), Clot Formation Time (CFT), alpha angle (α), Amplitudes (A5, A10, A20), Maximal Clot Firmness (MCF), Lysis Index (LI 30) and Maximum Lysis (ML) and the Interpretation section explains how to interpret a temogram (Figure 1). Whereas the Interactive Interpretation Module, is logic based and developed using current peer-reviewed published algorithms. It allows for direct entry to the App of patient specific ROTEM parameter values, then displaying the interpretation of normal or abnormal results such as clotting factor, platelet or fibrinogen deficiency, hyperfibrinolysis or heparin effect and subsequent recommendations for appropriate blood product use.

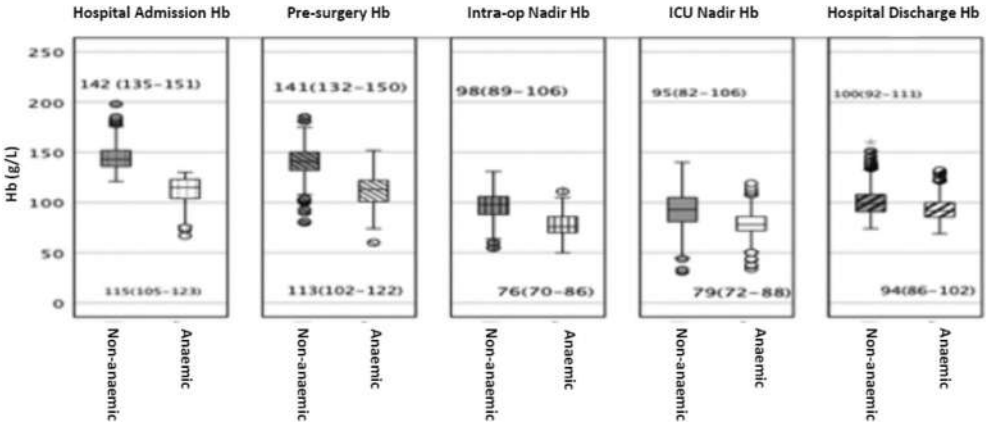

Figure 1 Pre-surgery, discharge, and intra-operative and ICU nadir median haemoglobin levels

Figure 1 iTEM interpretation and educational modules

Conclusion: The App is readily available to all laboratory and medical staff and will assist with the diagnosis of coagulopathy and guide appropriate blood product use in different clinical situations.

Detection of *Treponema pallidum* DNA in blood from donors seropositive for syphilis consistent with current risk modeling

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Aim: *Treponema pallidum* bacteraemia carries a risk of transmitting syphilis through transfusion. Australian Red Cross Lifeblood manages this risk using donor screening and serological testing in combination with modern blood processing practices. A recent risk model estimated ~12% of seropositive donors are bacteraemic at time of donation. As it is difficult to culture *T. pallidum*, and serology test results do not necessarily equate to infectivity, nucleic acid detection could be used as a surrogate for detection of the pathogen in blood and indication of potential infectivity. The aim of this study is to determine the presence of *T. pallidum* nucleic acid in serologically syphilis reactive donations and pre-index donations.

Method: Syphilis reactive blood samples from 2014–2019 ($n = 34$) and, for repeat donors, pre-index donations (within 12 weeks prior; $n = 24$) were retrieved from Lifeblood archive. These samples were selected from donors that tested positive for *T. pallidum* haemagglutination confirmed by specific test positive as well as non-specific, rapid plasma reagin (RPR) or Venereal Disease Research Laboratory (VDRL) test positive. To detect *T. pallidum* nucleic acid, DNA was extracted and tested by quantitative real time PCR for two conserved species-specific regions, *pol-A* and *16S*.

Results: *T. pallidum pol-A* DNA was found in 7 of 58 retrieved plasma samples, and 4 of the *pol-A* positive samples were also positive for *T. pallidum 16S* DNA. Positive tested samples were either high in RPR titre (64) or VDRL titre (32).

Conclusion: Our study demonstrates that the prevalence of *T. pallidum* nucleic acid (12%) is close to the previous risk modeling in Australian blood donors. As these samples had high RPR/VDRL titres and were discarded, the risk of syphilis transfusion transmission is negligible. This indicates that our existing strategy is sufficient to identify donations at potentially higher risk of transmission via transfusion.

A quality assurance analysis of fetomaternal haemorrhage testing across Australia and New Zealand and the accuracy of these methods for the dosing of *RHD* immunoglobulin

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Aim: There is little standardisation in the laboratory techniques used to estimate fetomaternal haemorrhage (FMH). The RCPA Quality Assurance Program (QAP) results historically demonstrate wide variations in FMH methodologies across participants. The recently released revised ANZSBT Guidelines for the Laboratory Estimation of Fetomaternal Haemorrhage provide additional recommendations to address in response to a survey of laboratories across Australia and New Zealand in 2019. The study aims to understand the current laboratory practices for FMH quantification and perform a quality assurance analysis of FMH testing and its impact on RhD Immunoglobulin (RhD Ig) dose recommendations of Australia and New Zealand laboratories participating in the RCPAQAP.

Method: A retrospective analysis was performed on pre-collected and deidentified data from the survey performed by the ANZSBT Transfusion Science Standing Committee and the RCPAQAP FMH Estimation Surveys from 2018 to 2020. Data was collated using Microsoft Excel. Quantitative analysis of the RCPAQAP data was performed using simple statistics. Responses from the ANZSBT survey were assessed manually.

Results: In the ANZSBT survey, 85% of participating laboratories perform Kleihauer-Betke (KB) compared to flow cytometry (FC) for quantitation of FMH - laboratory practises are discussed in detail. In the RCPAQAP survey, at least twice the number of laboratories utilised KB. The FC method demonstrated lower mean, standard deviations, and coefficient of variations within each run when compared to KB for each sample. The was a tendency towards a higher number of recommended vials of RhD Ig using KB compared to FC, although

overall, the median FMH results and number of recommended RhD Ig vials are similar.

Conclusion: FC offers technical advantages for FMH quantitation; however, KB is the most common method used and remains an adequate method for FMH testing due to availability, staffing proficiency and cost. Our hypothesis is standardisation through the new guidelines will improve the accuracy of KB.

The national thrombotrol-VF audit: Recent trends and current practice in New Zealand

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Aim: To investigate New Zealand's requirements for antithrombin III concentrate (Thrombotrol-VF), its clinical use and efficacy across the country, so that the New Zealand Blood Service can ensure adequate ongoing supply and provide recommendations on its future use.

Method: A national retrospective audit was conducted in two parts. First part pertains to the national demand for Thrombotrol-VF; this included all Thrombotrol-VF requests in NZ between 1st of January 2015 and 31st of December 2020. Part two included all Thrombotrol-VF requests in NZ between 1st of July 2020 and 30th of June 2021. The corresponding patient demographics, treatment indications, appropriateness of requests and post-treatment ACT or ATIII levels were analysed.

Results: Part I: A total of 984 Thrombotrol-VF vials (each vial contains 1000 IU of antithrombin) were issued between 2015 and 2020. There was a trajectory towards increasing total vials per annum and total patients per annum. Significant differences in the demand for Thrombotrol-VF exist between different regions of NZ. Interestingly, Canterbury region has consistently required the most vials (41%), yet Auckland region accounts for most patients (33%).

Part II: Within the 12-month timeframe, there were 201 separate requests for Thrombotrol-VF, corresponding to a total of 233 vials and issued to a total of 71 patients. Thromboprophylaxis following L-Asparaginase induced antithrombin deficiency was the most common indication for Thrombotrol-VF use (46.4%). There are significant variations in clinical practice for this indication across the country, and no national standardised guideline exists. Lastly, 80% of the Thrombotrol-VF requests were appropriate and only 60% met the target ACT or ATIII level for each of their locality.

Conclusion: This is the first national audit on Antithrombin III concentrate use in New Zealand and has provided significant insight into its use. In particular, it has demonstrated the increasing demand for this product and the need for nationally standardised guidelines.

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Utility of an improved haemovigilance review process utilising a standardised proforma guide in an Australian tertiary hospital

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Aim: To describe the utility of a locally developed and systematic haemovigilance review process utilising a standardised proforma guide to improve quality and safety of transfusion practice at an Australian tertiary metropolitan centre.

Method: Reported cases of suspected transfusion reactions, transfusion-related adverse events, use of uncross-matched O RhD-negative red cells (RBCs) and massive transfusion (MT) episodes are reviewed fortnightly in a haemovigilance review subcommittee. A key improvement of this process is a standardised proforma guide. Details captured include patient demographics, clinical details and outcomes of any events, comorbidities, time from patient arrival to pre-transfusion specimen collection and receipt in laboratory, time from arrival in specimen collection to transfusion laboratory, time from blood component/product request to release and transfusion,

frequency of full blood examination and coagulation testing, total component provision and ratios (in MTs), component waste, communication between all clinical teams involved and the transfusion laboratory staff, details of clinical symptoms and signs of suspected transfusion reaction and findings/likely diagnosis/recommendations from transfusion reaction investigations, made available in the patient's medical record. A document summary is provided to the Hospital Transfusion Committee (HTC) and incidents are reported to Victorian Serious Transfusions Incident Reporting (STIR) as per their guidelines.

Results: A total of 348 cases between March 2020 and April 2022 were reviewed. Of these cases, 139 were MT cases, 93 were instances of use of emergency uncrossmatched O RhD-negative red cell units and 166 cases of suspected transfusion reaction. Areas identified for improvement include communication issues, delays in specimen delivery and blood component waste minimisation.

Conclusion: The haemovigilance review sub-committee of the HTC continues to review events to optimise transfusion safety. Use of an improved standardised proforma guide has provided a streamlined process to review each transfusion-related event in a systematic manner ensuring that every step of the transfusion chain is monitored.

#GotBlood2Give: Exploring the experiences of black men who have sex with men (cis and trans) with blood donation in Canada

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Aim: In Canada, there is a paucity of research aimed at understanding the experiences of Black gay, bisexual, queer and trans men (GBQTM) in relation to health, including barriers to becoming blood donors. Black GBQTM face intersecting forms of erasure and silencing due, in part, to racism, sexism, homophobia, transphobia in both queer communities and the wider Canadian community. The HIV epidemic has uniquely shaped the way that Black GBQTM have been thought about and presented in research, which have informed specific questions in the Canadian Blood Services (CBS) donor questionnaire. While the donor questionnaire continues to evolve – with questions being removed, rewritten, and updated – questions about GBQTM remain contentions. The aim of this project was to better understand the experiences of Black GBQTM in relation to blood donation in Canada.

Method: #GotBlood2Give is an ongoing mixed-methods three-part research project conducted in Halifax, Montréal, Ottawa, and Toronto. We report findings from part one – an online quantitative survey distributed to Black GBQTM. Parts two and three consist of interviews with Black GBQTM.

Results: 286 Black GBQTM completed the online survey. Only 16.4% ($n = 47$) of participants reported having ever donated blood. The most frequent reasons for having donated blood were that blood donation was something they believed in ($n = 30$, 63.8%) and they felt that they were helping others ($n = 27$, 57.4%). Among those who did not donate blood ($n = 210$, 73.4%), the most reported reasons were that CBS did not allow them to donate ($n = 49$, 23.7%) and that they had never been asked to donate blood ($n = 40$, 19.3%). The remainder ($n = 29$, 10.1%) skipped/preferred not to answer these multiple response questions.

Conclusion: Our findings suggest that Black GBQTM experience intersecting forms of discrimination reflecting broader CBS donor policies. In 2022, CBS introduced a new behaviour-based policy, which we believe still falls short in identifying low-risk Black GBQTM who should be eligible to donate blood. Recommendations from this study highlight suggested changes to the CBS donor questionnaire that would improve blood donation experiences for Black GBQTM.

Group O whole blood product retains haemostatic potential for at least 21 days of cold storage

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Aim: Australian Red Cross Lifeblood does not currently supply a whole blood (WB) product. Group O WB has been shown to improve outcomes in military settings, and early administration of blood products to trauma patients with severe bleeding improves their survival, hence WB could be suitable for Australia's pre-hospital or regional locations. The aim of the study was to evaluate the quality and function of RBCs, platelets and plasma proteins from cold-stored WB product.

Method: WB ($n = 24$) was collected into CPD anticoagulant, held overnight, processed through a platelet-sparing filter, and stored at 2–6°C for 42 days. Samples were taken on day 1, 4, 7, 14, 21, 28, 35 and 42, and RBC, platelet and coagulation factor quality and function were measured.

Results: WB units were effectively leucoreduced, with 85% recovery platelet count following filtration. One third of the WB units processed were significantly lipaemic, with a visible lipid layer appearing after overnight cold storage. Haemoglobin levels remained constant throughout storage ($p = 0.122$). Lipaemic units were more turbid with a higher percentage of haemolysis when compared to non-lipaemic units ($p = 0.003$), and subsequently failed to meet the 0.8% haemolysis specification. Platelet count decreased during storage, and the R time and the maximum amplitude (thromboelastography) decreased during cold storage (both $p < 0.0001$), although not affected by the presence of lipaemia. Fibrinogen concentration remained constant ($p = 0.0127$), whereas both FVIII and FV decreased during storage (both $p < 0.0001$). There was an increase in platelet-derived and RBC-derived microparticle numbers during WB storage ($p = 0.00014$ and $p = 0.023$, respectively).

Conclusion: WB retains haemostatic potential for at least 21 days of cold storage, and with further development, may be suitable for transfusion in Australia. However, the effects of lipaemia need to be considered if WB is to be used routinely, as it can interfere with quality control measurements such as haemolysis.

Emergency blood coordinator: A formal role for emergency department massive transfusion protocol resuscitations

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Background: In 6 months (from September 2020), 83 blood product units were wasted during massive transfusion protocol (MTP) activations in Liverpool Emergency Department (ED). Five additional blood-related incidents were reported on the Incident Management System (IMS). Investigation discovered cold-chain breaches in ED and during patient transfer from ED. Issues with administration and the coordination of MTP shipments from blood bank were also discovered. The aim of this project was to reduce MTP blood wastage and improve cold-chain management, administration, and patient safety along with blood product communication and handover processes.

Method: Following multidisciplinary stakeholder engagement, a Blood Coordinator role was implemented in March 2021. The Blood Coordinator is a designated resuscitation team member whose primary role is to act as the direct point of contact between blood bank and ED. They are to assist with the crosscheck and administration of MTP blood products and must be competent with the rapid infuser. They are required to maintain cold-chain and formalise transfusion documentation within ED and upon transfer. Communication and education were provided to stakeholders with MTP activation now including the addition of a portable whiteboard to assist with tallying blood products, an alarming timer attached to MTP shipments and a blood coordinator phone for direct communication.

Results: Post implementation, blood product wastage reduced from 13.8 to 8.6 units/month. IMS reports also decreased from 5 incidents during six-months to only 2. Communication between teams has also improved. This demonstrates a significant reduction in blood product wastage in an MTP and shows an improvement in teamwork and patient safety.

Conclusion: Allocation of a Blood Coordinator for an MTP is embedded in practice in Liverpool ED and has reduced blood wastage and improved patient safety. Other facilities with high MTP activations could implement a similar role to reduce blood wastage, improve patient safety and cold chain management.

Increasing the time-to-freezing for clinical apheresis plasma

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Aim: The vast distances between blood collection centres and blood processing facilities make it challenging to align clinical plasma supply with demand. Increasing the time-to-freezing for clinical plasma would alleviate many of these issues. This study aimed to compare the quality of clinical apheresis plasma frozen within 6 and 12 h of collection.

Method: Apheresis plasma ($n = 20$) collected at donor centres was immediately transported to a blood processing facility, where the plasma was stored at 26°C, to replicate a worst-case scenario for shipping plasma during high external temperatures. Plasma was sampled aseptically at 6, 8, and 12 h post-collection and frozen immediately in a rapid plasma freezer. Upon thawing, coagulation factors were measured using a coagulation analyser, and complement C3a and C5a were measured by ELISA.

Results: FVIII concentration declined in plasma frozen at 6, 8 and 12 h post-collection (122 ± 27, 121 ± 25, and 116 ± 24% respectively) but did not reach a level of significance ($p = 0.3338$). Importantly all components met the Council of Europe specifications for FVIII (≥0.7 IU/mL). Fibrinogen and vWF concentrations remained constant from 6 to 12 h ($p = 0.3100$ and $p = 0.1281$ respectively). There were no significant differences in coagulation factors II, V, VII, and XIII in plasma frozen at 6, 8 or 12 h post-collection. C5a declined between 6, 8 and 12 h (58 ± 12, 56 ± 11, 56 ± 11 μg/mL respectively; $p = 0.2123$), whilst C3a was stable. Activated partial thromboplastin time, prothrombin time, antithrombin or protein C concentration were also not significantly different in plasma frozen within 6, 8 or 12 h from collection.

Conclusion: Clinical apheresis plasma can be frozen within 12 h of collection, thus allowing collection from more donor centres further from blood processing centres and increasing supply. Submission will be made to the regulator, Therapeutic Good Administration, for review and approval to introduce this change to Lifeblood processes.

Extending the post-thaw shelf life of cryoprecipitate

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Aim: Cryoprecipitate has a short post-thaw shelf life of 6 h, leading to very high rates of wastage. It may be feasible to extend this. The aim of this study was therefore to evaluate the quality of thawed cryoprecipitate stored at 4°C for up to 14 days.

Method: Three whole blood (WB) or two apheresis cryoprecipitate components were pooled and split into nine paediatric packs ($n = 20$), and stored at 4°C. One paediatric pack from each pool was sampled at 6, 24, 48, and 72 h, and day 7 and 14 post-thaw. Coagulation factors and fibrinogen were measured by coagulation analyser. Fibronectin and complement C3a and C5a were measured by ELISA. Thrombin generation was measured by calibrated automated thrombogram. The remaining samples were screened for bacterial contamination.

Results: FVIII declined significantly in WB ($p = 0.0002$) and apheresis cryoprecipitate ($p < 0.0001$) after 6 and 24 h respectively. Despite these decreases all cryoprecipitate met FVIII specifications on day 7 post-thaw. Fibrinogen was stable for 72 h, then gradually decreased in both WB and apheresis cryoprecipitate, still meeting specifications on day 14. There were minor decreases in FII, FIX and FXIII over the 14 days of storage, whereas FV decreased significantly by 48 h post-thaw for both WB and apheresis cryoprecipitate ($p < 0.0001$, $p = 0.0047$ respectively). Fibronectin, vWF and C5a were stable, whilst C3a increased 9-fold over the 14 days ($p < 0.0001$). There were small but significant decreases in thrombin generation lag time, endogenous thrombin potential and time to peak for both WB and apheresis cryoprecipitate. Importantly, there was an increasing amount of reprecipitation observed in the cryoprecipitate during post-thaw storage at 4°C, which became more challenging to redissolve later in storage. All cryoprecipitate components were negative upon bacterial culture.

Conclusion: WB and apheresis-derived cryoprecipitate still meet the Council of Europe specifications after 7 days post-thaw storage at 4°C.

Use of half RBC units in oncology patients during severe RBC shortage to extend hospital supply

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Background/Case Studies: Blood supply during the COVID-19 pandemic was at record lows due to blood drive cancelations, fear of contracting COVID-19, and COVID-19 donor deferrals. Splitting platelet units is a well-known method of extending platelet supply. Due to the blood type O RBC shortage during the pandemic, we split one RBC unit into two half-units to extend the RBC supply. RBC splitting has been utilized in pediatric and fluid overloaded patients; however, there is no research demonstrating the effectiveness of RBC splitting to extend RBC supply.

Study Design/Methods: We examined transfusion data on half and whole RBC units transfused from May 21, 2021 to November 1, 2021. The criteria for half-unit transfusion were dependent on the blood supply. In general, if there was less than 1 day supply of RBC units on hand, half-units were issued for stable, non-bleeding patients with hemoglobin above 7.0 g/dL in outpatients and 6.5 g/dL in inpatients. During the study period if a patient received any half RBC units, the time between the first half-unit transfused to the next RBC transfusion within the next 90 days was noted. If a patient received only whole units during this time, we observed the time from the first RBC transfusion to the next RBC transfusion in the subsequent 90 days. Pre-transfusion hemoglobin was obtained the day of the transfusion and post-transfusion hemoglobin was obtained either the day of or day after the RBC transfusion.

Results/Findings: Over 6 months, 276 patients received only whole units and 229 patients received at least one half-unit. The median number of days to next transfusion in patients who received a transfusion within 90 days after a half-unit was 3 (mean 6.7 ± 11.4) and whole unit was 5 (mean 11.8 ± 16.7) ($p < 0.001$). There were 38 (16.6%) patients who did not receive a transfusion within 90 days of first transfusion after a half-unit and 62 (22.5%) patients after a whole unit. The median pre-transfusion hemoglobin in those transfused half-units was 6.9 (mean 6.9 ± 0.5) g/dL and whole units 7.0 (mean 7.2 ± 1.3) g/dL ($p < 0.001$). The median hemoglobin prior to the second transfusion was 6.8 (mean 6.8 ± 0.6) g/dL in those previously transfused half-units and 7.0 (mean 7.2 ± 1.1) g/dL after a previous whole unit ($p < 0.0001$). Of those transfused half-units, 46.7% received a second unit within 3 days, 56.8% within 5 days, and 65.9% within 7 days. After a whole unit, 30.4% received a second unit within 3 days, 37.3% within 5 days, and 44.9% within 7 days.

Conclusion: Our study demonstrates the use of half RBC units can extend RBC inventory in the short term. Patients transfused half-units received a second transfusion earlier than those who received a whole unit, median 3 days versus 5 days after whole unit ($p < 0.001$).

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