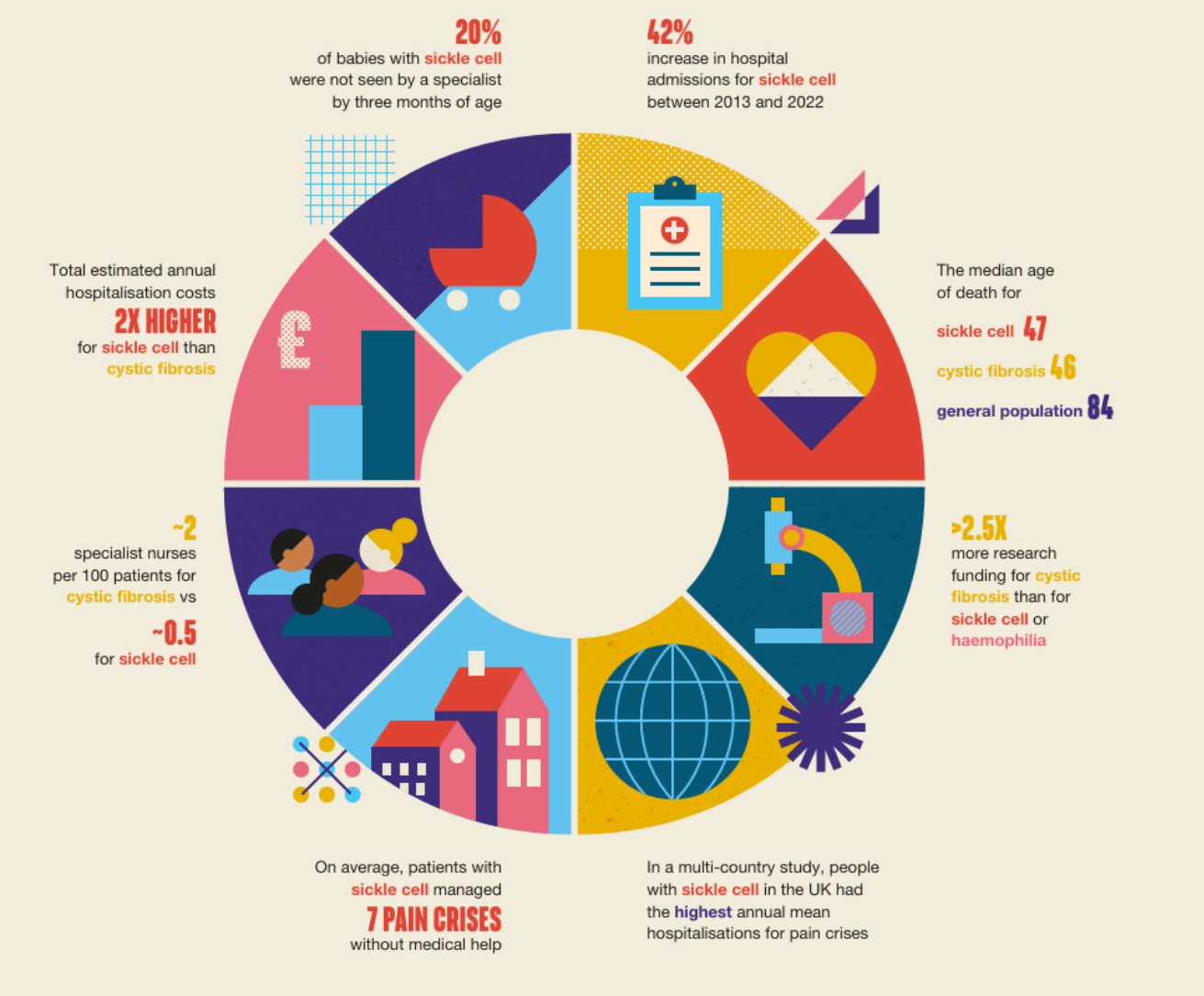
Transfusion in Sickle Cell Disease

Dr Andi Fletcher
Consultant Haematologist
Associate Medical Director – Donor Medicine
NHSBT

UK Growth – Patients with Sickle Cell Disease



17,000 people live with sickle cell disease (almost 25% in London)

>50% increase in admission rates over 10 years

75% of admissions occur in London

One admission associated with additional admissions in 74% of cases

9% have >4 30-day admissions per year

25% admissions in 10-29-year-olds

Almost £100 million (2019-2022)

Suitable transfusion would reduce all of these

SICKLE CELL SOCIETY NHS RACE & HEALTH OBSERVATORY 2025

A Patient Story

- A young adult was admitted on a Friday afternoon with severe pain in her legs, pelvis and lower back
- She had gone very yellow over the past 2 days and had developed a high fever in this time
- She had been admitted repeatedly over the past 12 months with recurrent vaso-occlusive crises, gall stones and tummy pain due to her spleen getting bigger
- She was on hydroxycarbamide for over 10 years with a good HbS level >20%

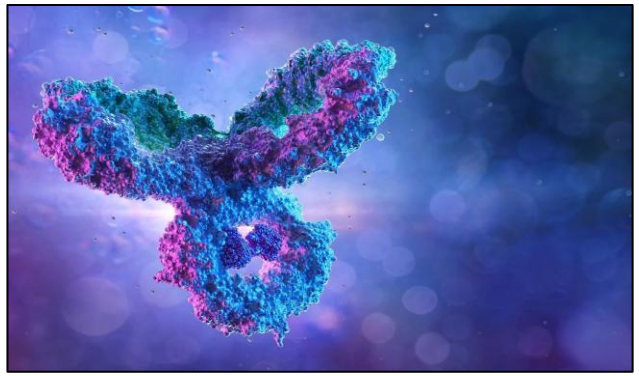
A Patient Story

- A young adult was admitted on a Friday afternoon with severe pain in her legs, pelvis and lower back
- She had gone very yellow over the past 2 days and had developed a high fever in this time
- She had been admitted repeatedly over the past 12 months with recurrent vaso-occlusive crises, gall stones and tummy pain due to her spleen getting bigger
- She was on hydroxycarbamide for over 10 years, but response was less good recently
- She had her first exchange transfusion 10 days ago in preparation for a stem cell transplant
- Her wee looked like coca-cola

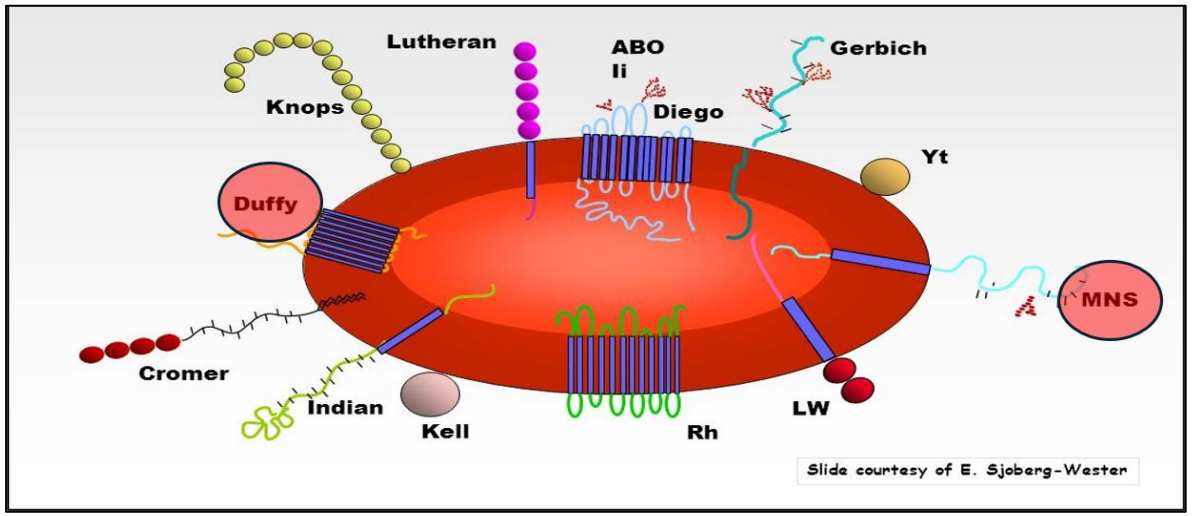


Hyperhaemolysis





anti-Jka
anti-Lea
probably anti-Fy3.
suspicion of an anti-S



Transfusion Reasons - Guidelines and Standards

60% or patients with sickle cell disease will need at least one transfusion

20% of UK blood supply goes to patients with sickle cell disease

1. Correct acute anaemia
2. Reduce sickle haemoglobin concentration in relation to adult haemoglobin
3. Surgery
4. Pregnancy

Longer list at end

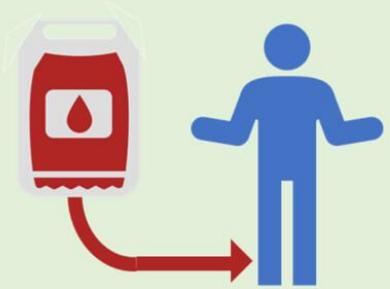
Davis, et al. British Society for Haematology (2017). Br J Haematol, 176: 192-209.
Standards for Clinical Care of Adults with Sickle Cell Disease in the UK, 2018.

Transfusion Options – Individualise for everyone

Simple transfusion

Advantages
- Possible peripheral venous access.
- Requires the fewest red cell units.

Disadvantages
- Hyperviscosity and circulatory overload.
- Iron overloading.



Manual RBCX

Advantages
- Can be done peripherally but may need central line.
- Minimizes blood volume shifts through sequential manual bleeding and infusing.

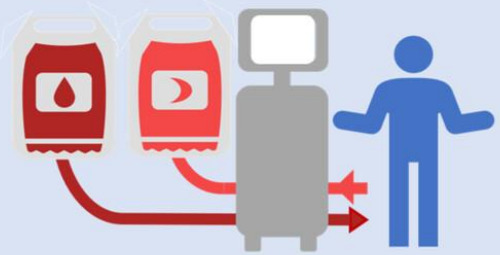
Disadvantages
- More red cell units per treatment than simple transfusion.
- Specific training.



Automated RBCX

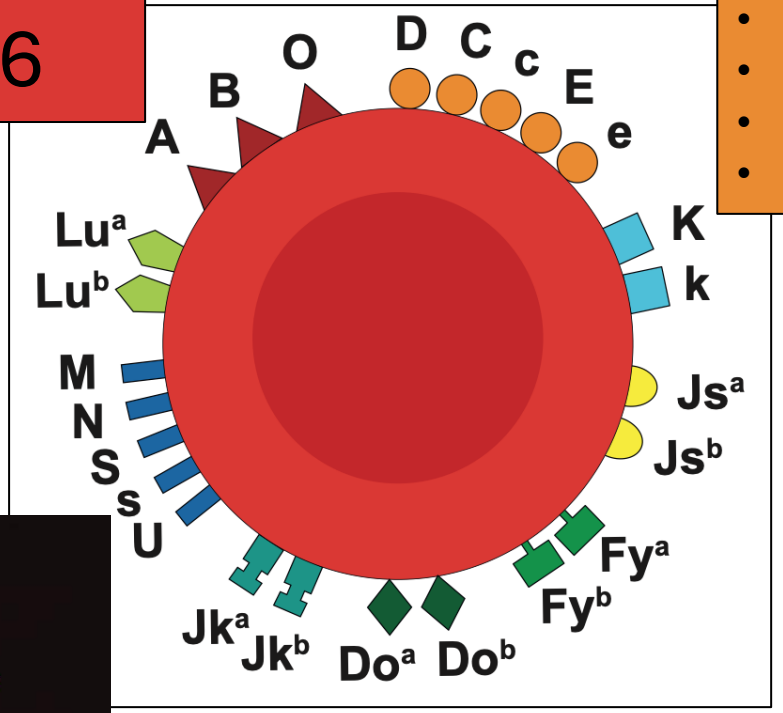
Advantages
- Can be done peripherally but may need central line.
- Minimizes blood volume shifts through continuous removal and replacement.
- Accurate control of HbS, haematocrit, overall fluid balance.
- Lowest treatment frequency.

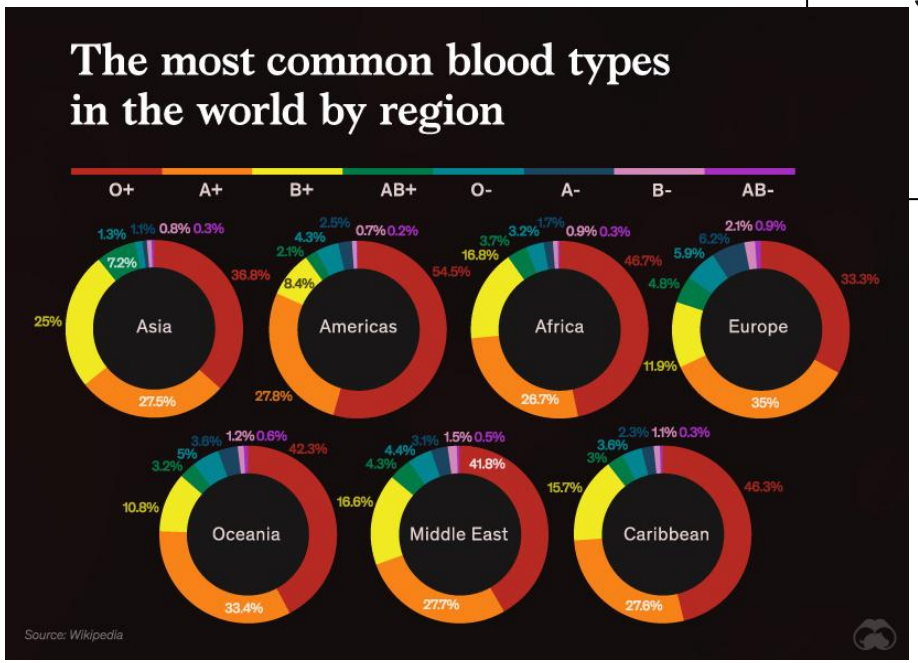
Disadvantages
- Specialized device and training.
- The most red cell units per treatment



Dierick K, et al. *Vox Sang*. 2025; 120: 4–12.

49 Blood Groups
as of September 2026





R_0 (Dce/Dce) phenotype

- D positive
- c positive
- e positive
- C negative
- E negative

Up to 56% of Black heritage donors
1 in 3 successful donations
But
<10% of European heritage donors
1 in 10 successful donations

Kell (K):
1-2% Black heritage
9% European heritage

Duffy (Fy): Fy (a-b-)
60-70% Black heritage
<1% European heritage

S
25-35% Black heritage
55% European heritage

Kidd (Jk): Jk^b
50% Black heritage
73% European heritage

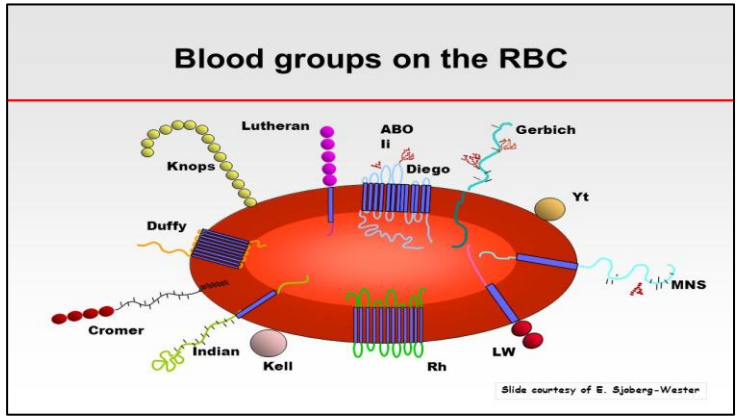
Extended Phenotype:

C, c, E, e, K, k, Jka, Jkb, Fya, Fyb, S, s [U]

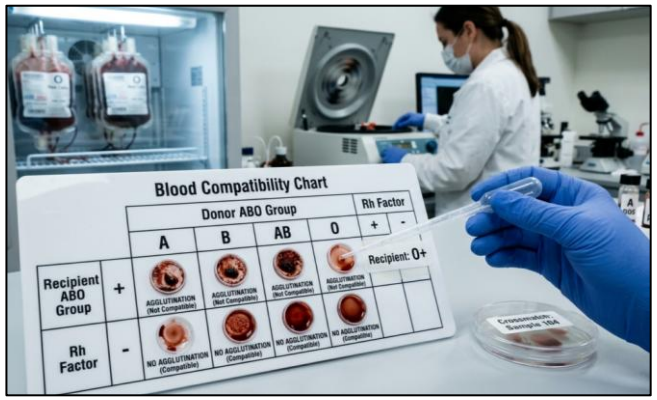
visualcapitalist.com 2021

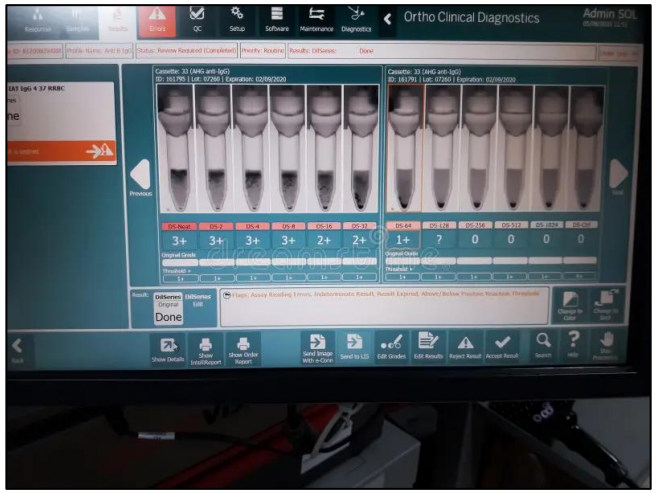
Matching Blood

Patient



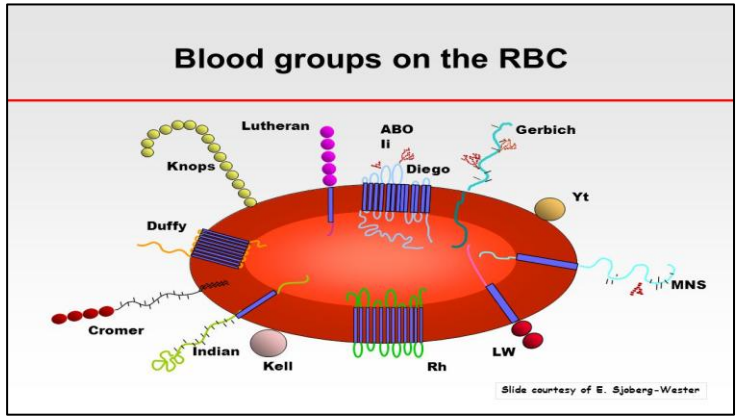






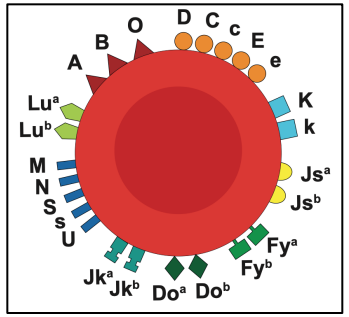


Blood Donor





Ro Substitutions



R_0 (Dce/Dce) phenotype

- D positive
- c positive
- e positive
- C negative
- E negative

Up to 56% of Black heritage donors
1 in 3 successful donations
But
<10% of European heritage donors
1 in 10 successful donations

- One donation from a Ro donor may help provide better-matched blood for a patient with sickle cell disorder and reduce the risk of transfusion complications.
- Ro blood donors are relatively uncommon in the UK donor population.
- NHSBT can currently meet 50% of the Ro demand across the NHS.
- Demand has grown >100% over past 10 years
- Substituting :

ABO matched

Ro matched
D pos
C, c, E, e neg

Extended Phenotype Matched

K

And Jka, Jkb, Fya, Fyb, S, s [U] - if available

Haemolytic Transfusion Reactions

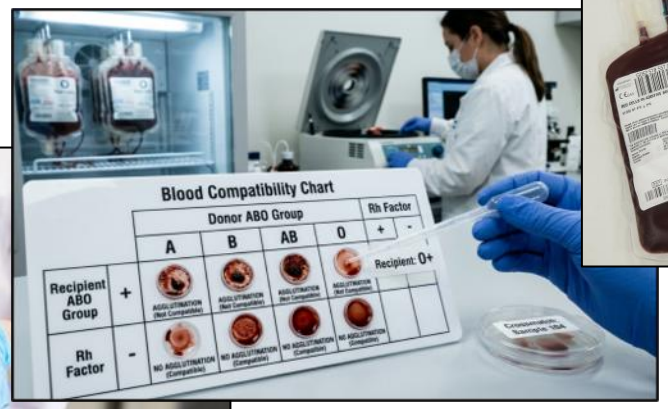
Acute (<24 hours)	Hyperhaemolysis	Delayed (>24 hours)
ABO	Patient Antibodies destroy transfused and own cells	Other Blood Groups
Immune system activation	Immune system activation	Antibodies only
Destroy transfused and own red cells	Inflammatory environment leads to widespread effects beyond blood	Destroy transfused red cells
Severe anaemia	Sickle cell disease also causes haemolyisis by other mechanisms – VOC, infection/fever, drugs	No/mild anaemia
Severe jaundice	Severe anaemia	Moderate jaundice
Incompatible crossmatch before transfusion	Severe jaundice	DAT +ve
	Compatible crossmatch before transfusion	Compatible crossmatch before transfusion
	Haemoglobinuria	

Blood Journey

NHS Blood and Transplant

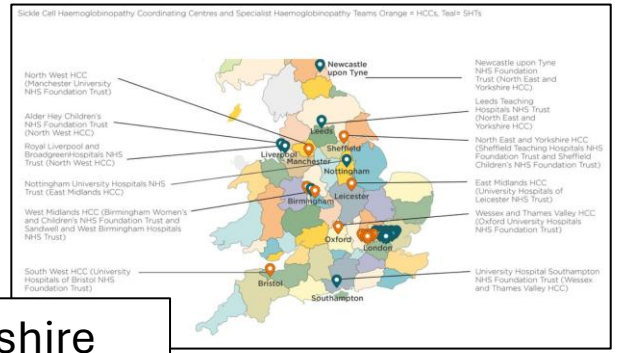




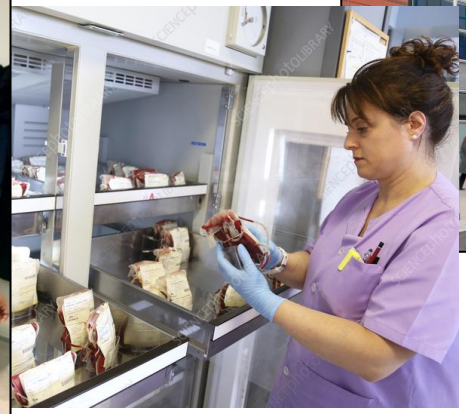












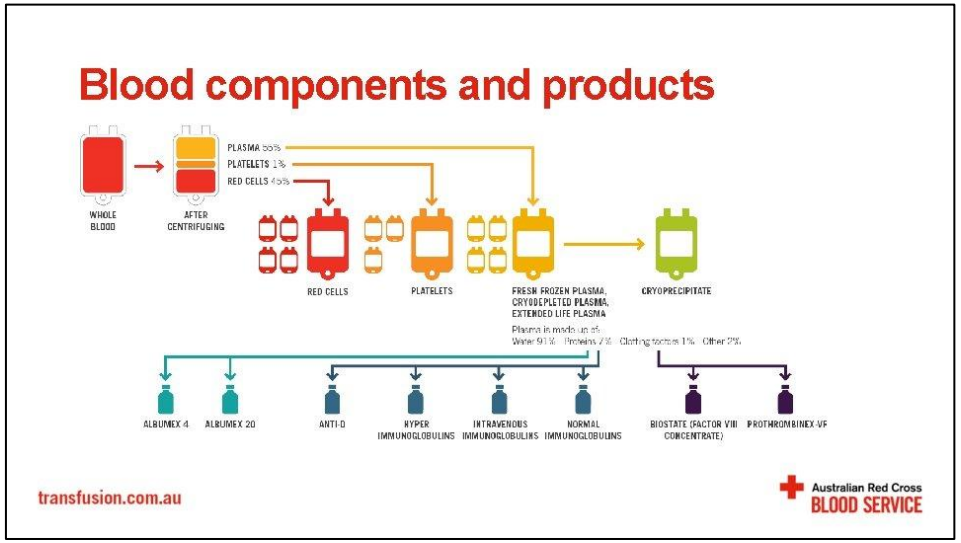


North East & Yorkshire

14 different hospital teams

NHS England

More to Blood the Red Cells



Donor Red cells
Donor Plasma – donor proteins
Anticoagulant
Preservative



Allergic reactions – itch, rash, anaphylaxis

Tingling sensation, heart palpitations, low blood pressure

Nausea, vomiting

Improving the blood supply - Donor Base

Total Donor Base

1.8 million

Active/Return Donor Base

800,000

Donor Deferrals

300,000

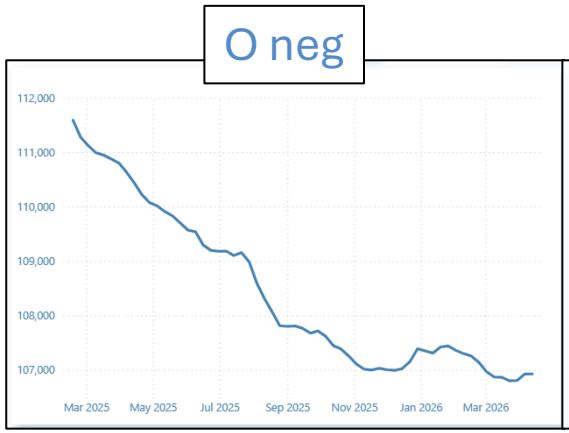
Active Return Donors

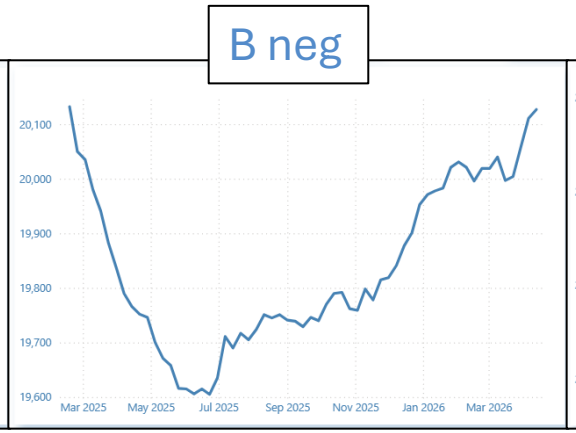
500,000

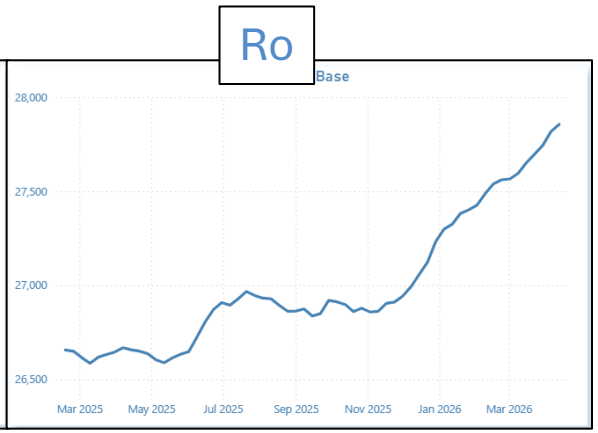
Return Donors after Deferral

50%

Young
Black Heritage
Low
Haemoglobin





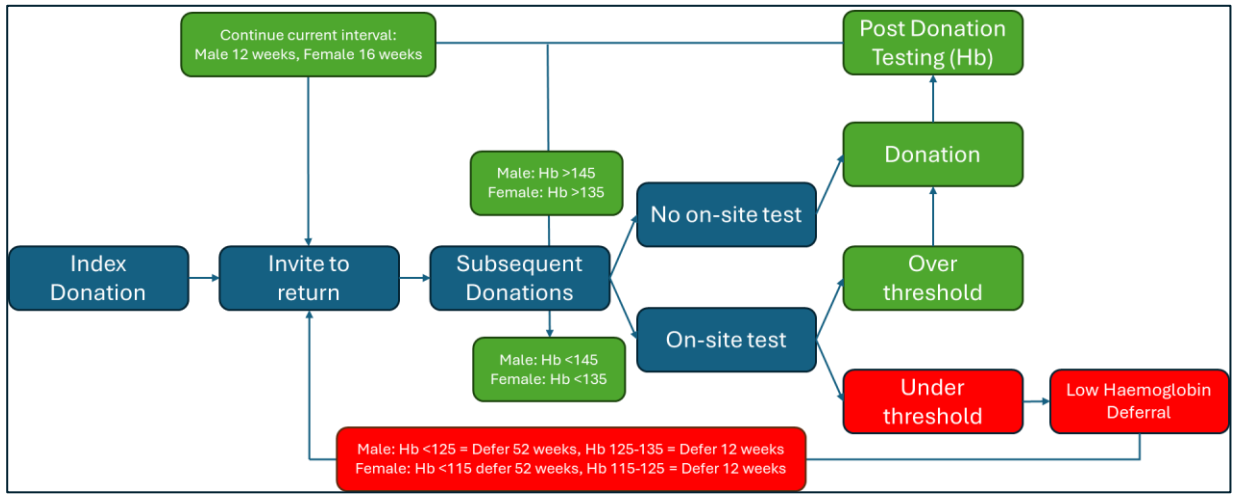




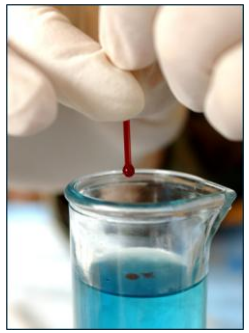


Improving Donor Health Through Testing

Post-Donation Testing

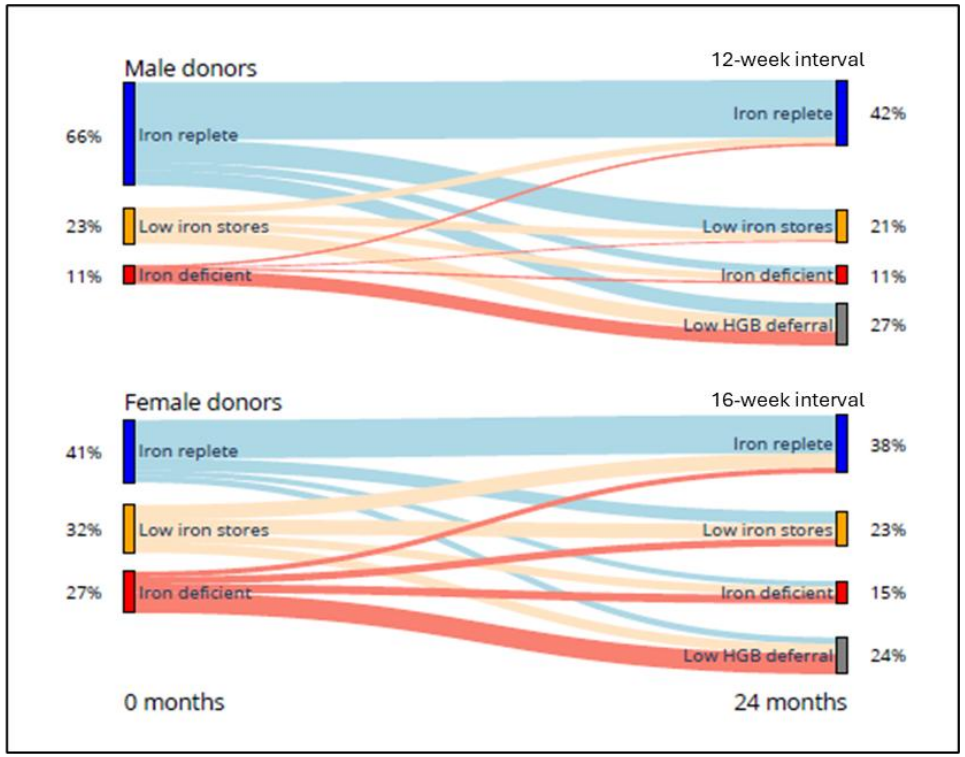


Allows personalised care









INTERVAL Trial Data

Assessed using Sysmex Rich-CBC data

Kreuter et al, 2025

Improving Donor Care - Pathing





Screening and Testing

Blood Group
Blood Count
Iron Status
Genotyping
- HLA/HPA/HNA typing
- Iron Metabolism
- Haemoglobin genes
- Red cell disorders

Diet
- Iron content
- Fatty foods

Collection Method

Whole Blood

Apheresis

Red Cells – General, Paediatric

Platelets
General, HLA/HPA matched

Plasma – Therapeutic,
Fractionation – IVIG, Albumin

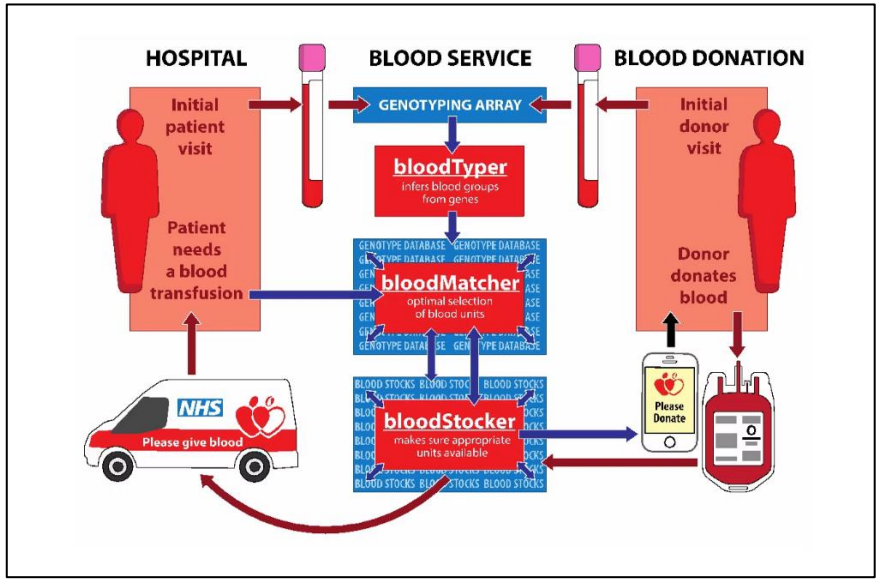
Non-clinical issue
Reagents, research, industry

Improving Patient – Donor Matching

- HaemMatch and Blood Matcher Projects

Haem Match

- Matched blood at genetic level = Precision/Personalised Care

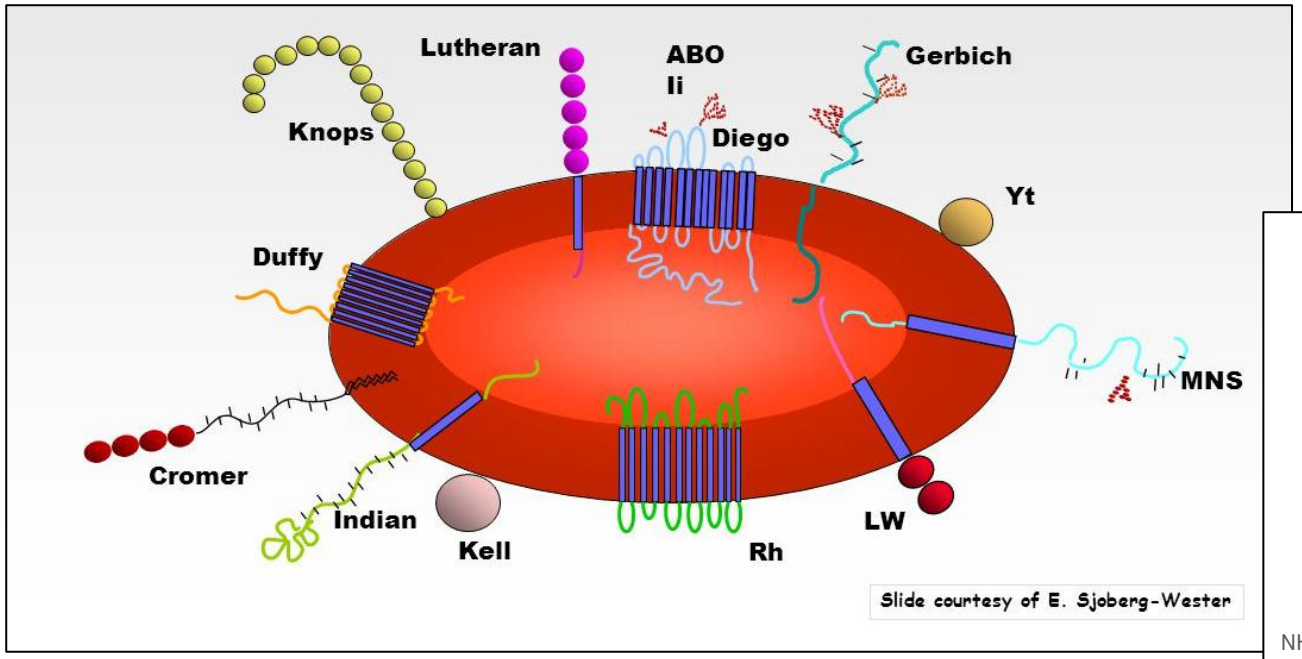


Aims:
-to improve transfusion safety in any one needing long-term transfusion
-to reduce the current 17% of patients with antibodies

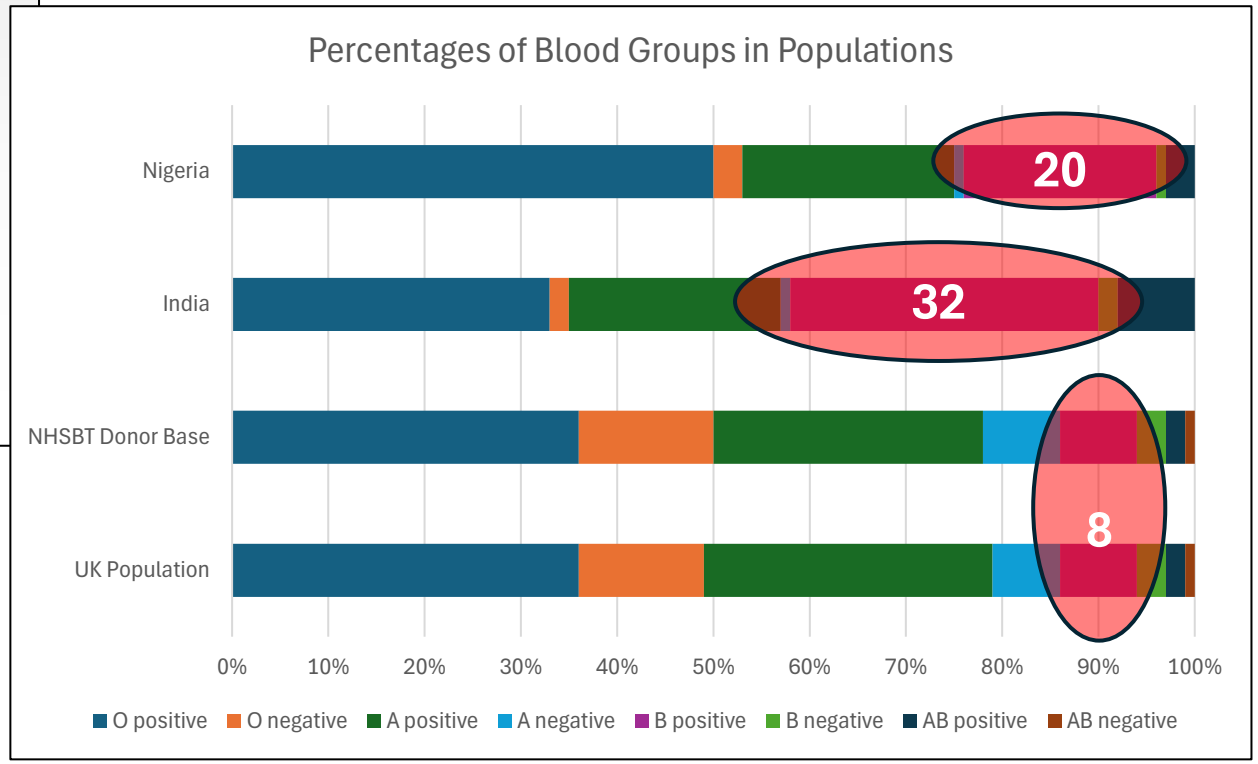
Summary

- Transfusion is a complex, individualised decision
- Blood groups are different in different population groups
- Even when correctly matched, blood transfusion can lead to complications
- Improvements are being made at each step of the pathway to improve transfusion care in sickle cell disease across the UK

Blood Groups – UK Population vs Others



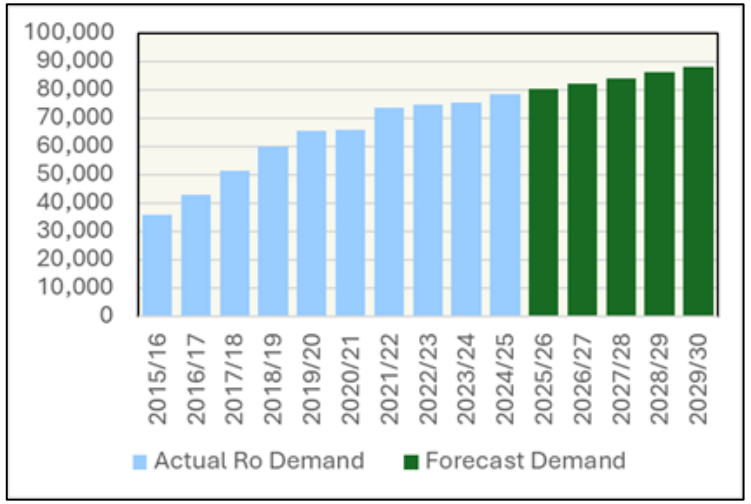
Ro = cDe	
UK	3%
Asian Heritage	2%
Black Heritage (BH)	30-50%
NHSBT BH Donors	(36%) 45%



NHSBT 2025; World Population Review 2025

Black Heritage Donors – Ro Blood Group

- 13% of all red cell demand is for Ro units
- NHS aims to meet 50% or Ro requirements from hospitals. Target is to meet 60% by 2029/2030 within the £3 million funded Donor Base Resilience Project
- Demand has grown >100% over past 10 years
- Ro population prevalence is 45% in Black Heritage and 1% in non-Black Heritage groups
- 1 in 3 new BH donors coming to donate lead to a collection of a Ro unit due to donor deferral



Transfusion Reasons

British Society of Haematology Guidelines 2016

1. Correct acute anaemia
   - Aplastic crisis
   - Acute splenic sequestration
   - Acute hepatic sequestration
   - Delayed haemolytic transfusion reaction
2. Reduce sickle haemoglobin concentration in relation to adult haemoglobin
   - Acute Chest Syndrome
   - Acute stroke or other neurological deficit (e.g. TIA)
   - Acute multi-organ failure
   - Mesenteric/girdle syndrome
   - Severe sepsis
   - Acute intrahepatic cholestasis
   - Primary stroke prevention
   - Prevention of silent cerebral infarct recurrence
   - Secondary stroke prevention
3. Surgery
4. Pregnancy
   - Sickle complications (e.g. painful crises, ACS, stroke)
   - Severe anaemia
   - Risk to mum or baby – recurrent chest crises or painful crises

Davis, et al. British Society for Haematology (2017). Br J Haematol, 176: 192-209.
Standards for Clinical Care of Adults with Sickle Cell Disease in the UK, 2018.

British Society for Haematology
Listening • Learning • Leading

SICKLE CELL SOCIETY

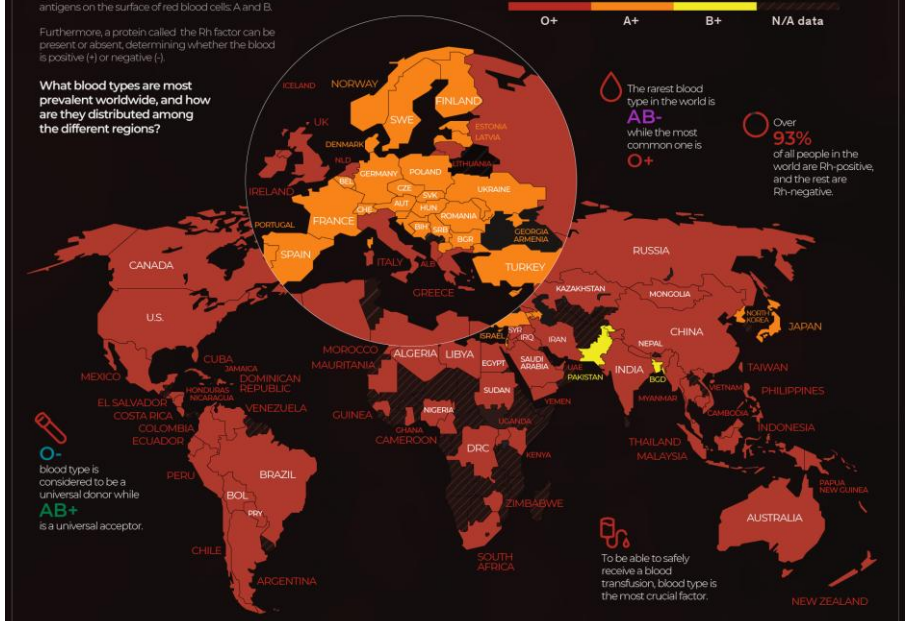
Blood Types
Around the World



The four blood types - A, B, O, and AB - are determined by the presence or absence of two antigens on the surface of red blood cells: A and B.

Furthermore, a protein called the Rh factor can be present or absent, determining whether the blood is positive (+) or negative (-).

What blood types are most prevalent worldwide, and how are they distributed among the different regions?



The rarest blood type in the world is **AB-** while the most common one is **O+**

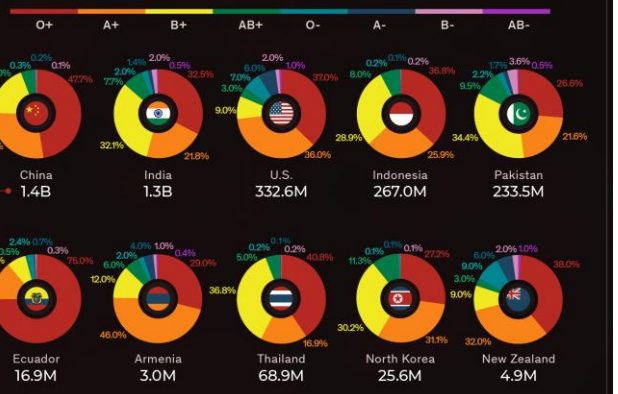
Over **93%** of all people in the world are Rh-positive, and the rest are Rh-negative.

O- blood type is considered to be a universal donor while **AB+** is a universal acceptor.

To be able to safely receive a blood transfusion, blood type is the most crucial factor.

DISTRIBUTION OF BLOOD TYPES BY COUNTRY

Selected Countries



Based on the 40 European countries included in this data, **33% of the continent's population has the blood type O+**. In comparison, 55% of the people in the Americas are O+.

Diverse cultures, living conditions, and hereditary lifestyles have changed the genetic makeup and blood types of individuals over centuries.

According to historical research, **blood type B is believed to have been entirely absent** from Native American and Australian Aboriginal populations prior to the arrival of Europeans in those areas.

Source: Wikipedia - Blood type distribution by country

VISUAL CAPITALIST COLLABORATORS RESEARCH + WRITING Raul Amoros, Anshool Deshmukh | DESIGN + ART DIRECTION Bhabna Banerjee, Clayton Wadsworth