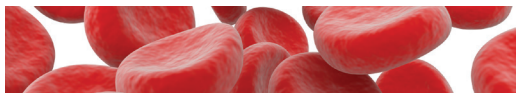
The use of O RhD negative red blood cells according to guidelines audit report 2018

blood matters



Australian Red Cross BLOOD SERVICE

VICTORIA State Government

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The use of O RhD negative red blood cells according to guidelines audit report 2018

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Contents

Background

The Australian Red Cross Blood Service (Blood Service) delivers one of the world's safest supplies of life-giving blood and blood products. It plays an important role in the Australian healthcare system, by collecting, processing and distributing blood products across Australia.

Health services have a responsibility to ensure the use of blood and its products is in accordance with clinical need and appropriate clinical practice (National Blood Authority [NBA] 2014) and accessible when required.

The Blood Service collects and manufactures blood that is given freely from nearly half a million donors to match supply with demand (where possible). This requires a careful balance between forecasting supply, and aligning collections and inventory with the demand from health services (Blood Service 2017). Over-collection of a product can lead to avoidable wastage and associated costs (such as blood donor's time, unnecessary processing and testing costs, and discarded product). On the other hand, under-collection can lead to a product not being available when required for patients.

It has been well documented that as patient blood management (PBM) becomes more widespread, fewer red-blood cell (RBC) units are transfused (Yazer et al. 2016, NBA 2017). Victorian issue data from 2011–2017 demonstrates a similar pattern as seen in Figure 1. The overall number of RBC issues from 2011–2017 declined 16 per cent. However, O RhD negative RBC issues have increased significantly over the same time period. This is reflected in the proportion of O RhD negative RBC units issued, as well as in absolute number (Table 1). This data demonstrates a mismatch between demand for 'universal' group O RhD negative RBC units and the proportion of the population who is O RhD negative (17 per cent demand versus 9 per cent population).

Figure 1: Victoria RBC issues 2011–2017

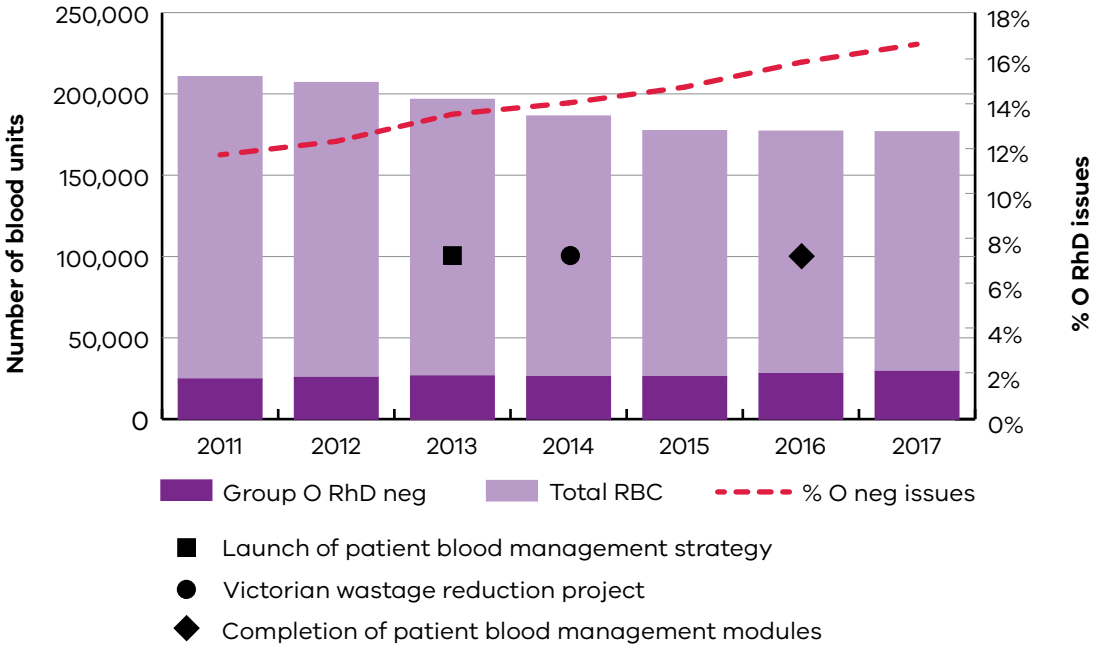


Table 1: Changes in RBC issues from 2011–2017

Victoria Data	2011	2017	Percentage change
Total RBC issues	210,593	176,685	-16%
O RhD neg issues	24,594	29,263	+19%
O RhD neg issues as a proportion of total RBC issues	12%	17%	+41%

The Australian Red Cross Blood Service and the National Blood Transfusion Committee (NBTC) developed and endorsed the Guidelines for the use of group O RhD negative red cells <http://www.transfusion.com.au/blood_products/components/red_cells/GroupO> in 2008.

The guidelines 'provide recommendations for the use of group O RhD negative red cells in order to conserve stocks and ensure availability for those patients for whom there is no alternative. In addition, they provide a framework that is designed to ensure that health services and pathology providers work in a consistent, integrated manner to manage shortages of group O RhD negative red cells' (Blood Service and NBTC 2008).

To date, efforts to meet the demand from health services for group O RhD negative RBC units has primarily focused on increasing donor numbers; however, with this increased demand, it is time to change the focus to what is driving the demand, and the clinical appropriateness of using group O RhD negative blood.

Hirani et al. (2017) published a review of the clinical use of group O RhD negative red cells in Australia during February 2015. They found 25 per cent of group O RhD negative red cells were transfused into patients of other ABO groups, with only 10 per cent transfused before their ABO group was known. They recommended strategies to reduce demand by re-evaluating inventory holdings, increasing the panel of phenotyped RBC units across all ABO groups, improved rotation of units between health services to minimise time expiry, and continuing education for promoting transfusion of ABO-identical RBC units.

The demand for blood products is continually changing and is predicted by a complex algorithm. The Blood Service and health services must work together to ensure there is equitable access to group O RhD negative RBC, in particular for those patients for whom there is no alternative, without putting an excessive burden on O RhD negative donors.

Objectives

The audit aimed to:

- document the use of group O RhD negative RBC units
- compare the characteristics of patients receiving group O RhD negative RBC units against the *Guidelines for the use of group O RhD negative red cells* (Blood Service & NBTC, 2008) to determine the true need for O RhD negative RBC units (opposed to perceived demand based on use).

Method

Blood Matters invited public and private health services in rural and metropolitan areas in four jurisdictions (Victoria n = 93, Northern Territory n = 5, Australian Capital Territory n = 3 and Tasmania n = 9) to complete a retrospective audit of all group O RhD negative RBC units used, rotated or discarded during November 2017. An excel audit worksheet was sent to each health service to complete electronically and return via email. The audit was open from 15 December 2017 to 2 February 2018.

Data presented in this report only includes Victorian health services. Other jurisdictions that completed the audit were provided with individual summary reports and a comparison with Victorian peer groups and overall data.

The audit had two parts:

- The policy component addressed guidance around when O RhD negative RBC units should be used, and any requirements to rotate RBC units to prevent expiry. In addition, where inventory was held, the usual inventory level of all RBC units was requested.
- The usage component of the audit required each unit of O RhD negative RBC to be audited and allocated a fate: transfused, rotated or discarded. For RBC units transfused, patient characteristics were documented: gender, year of birth, ABO group, RhD status, immune anti-D, specific phenotype requirement, need to receive repeat transfusions, ABO mismatched haemopoietic transplant, and clinical specialty. Further information on the transfusion episode was collected: urgency, massive transfusion protocol, blood group known at issue, number of O RhD negative RBC units transfused, number of RhD positive RBC units transfused, and total RBC units transfused. In addition, the health service was asked to identify the primary reason an O RhD negative RBC unit was selected.

Some health services and laboratories identified issues with completing the audit, as some laboratory information systems were not able to easily identify group O RhD negative RBC unit donation numbers used, transferred or discarded in the audit period. Where this was an issue, collaboration between the Blood Service and Blood Matters enabled provision of data to assist. Once appropriate RBC units were identified, their fate needed to be determined; and if the RBC unit was transfused, medical records were reviewed for patient characteristics.

Any RBC unit not meeting the inclusion criteria was excluded. That is, excluded RBC units were those that were:

- not used, rotated or discarded during the month of November
- duplicate data entries
- recalled by the Blood Service
- not a group O RhD negative RBC unit.

In addition, paediatric units were considered separately because these are 0.25 of an adult pack.

Data for each RBC unit submitted was run against an algorithm to determine the most likely indication of use based on the guidelines, or other reasons for use, for example, stock not held in inventory, special requirements (other than phenotypes), or used to prevent time expiry.

Algorithm results were compared with the indicated primary reason provided by the health service. To assist with validation, each participating health service was given a report of their individual data, indicating each RBC unit's final fate based on guidelines (as determined by the algorithm). Individual validation reports also included a summary of the percentage of group O RhD negative RBC units that met the Blood Service indications for use, and possible areas where the use may be questionable.

The summary report included data for the individual health service, applicable peer group, and overall data. Health services were given an opportunity to respond to the preliminary data.

Preliminary data received by the closing date (2 February 2018) showed patterns of use that raised concerns for the ongoing increase in demand for group O RhD negative RBCs. The Department of Health and Human Services Blood Pharmaceutical, Organ, and Tissue Donation program (funders of Victorian proportion of blood and blood products) and Private Hospitals Branch requested that Blood Matters follow up all health services who had not submitted data, and request that they do so. Understanding the current pattern of use for group O RhD negative RBC for all health services is imperative for government and the Blood Service to ensure that:

- product is available for patients when it is required
- there is equitable access to product
- donor welfare is respected.

Data submission was extended to June 2018 to provide additional time to initial nonreporting health services.

Results

Introduction

Audit response rates

The initial response rate for Victorian health services was 66 per cent (n = 61). After the extended data submission, all Victorian health services invited to participate responded (n = 93). Eight health services reported on policy and inventory only, because no group O RhD negative RBC units were used, rotated or discarded during November 2017 at these health services.

In November 2017, the Blood Service issued a total of 2,510 group O RhD negative RBC units, comprising adult (n = 2,467) and paediatric[1] (n = 43) RBC units, to Victorian Approved Health Providers.

Victorian health services submitted 2,701 reports, including 55 paediatric RBC units. Of these, 243 were excluded for various reasons. Reasons included that:

- the RBC unit was not used, rotated or discarded during November 2017 (n = 210)
- RBC unit not group O RhD negative (n = 21)
- duplicate entry (n = 11)
- recalled by the Blood Service (n = 1).

The paediatric RBC units (n = 55), for the purpose of this report, are considered separately to avoid confusion as each paediatric RBC unit is one-quarter of an adult unit.

Of the remaining 2,403 reports, 145 reports represented RBC units reported on multiple times by different health services due to rotations and/or transfers. This leaves 2,258 unique RBC units with reported movements (92 per cent of issued group O RhD negative RBC units in November 2017[2]). Of these, 2,035 RBC units were reported either transfused or discarded in November; the remaining RBC units (n = 223) were rotated or transferred with no further report of fate.

1 Paediatric RBC units are made from one donated unit and divided into four equal packs for the purpose of reducing donor exposure for small paediatric/neonatal transfusion and to reduce waste (Blood Service 2015).

2 This is only a proxy, as the audit captures units used, rotated or discarded in November 2017. Some of these units were issued in October, and others issued in November may not have been used, rotated or discarded during this time.

Figure 2: Breakdown of units reported

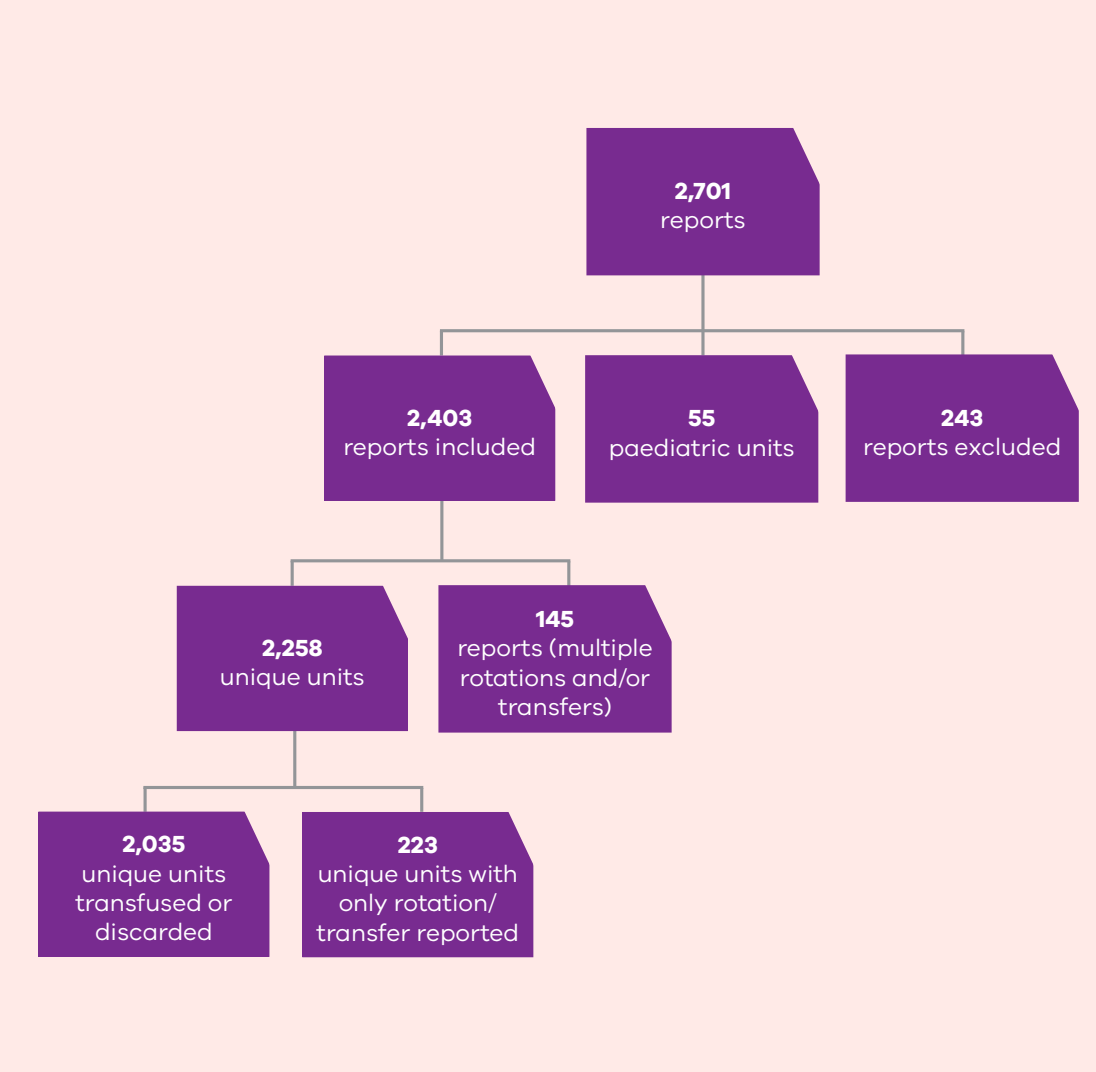


Table 2 summarises the health services that responded to the audit according to their peer grouping and the number of RhD O negative RBC units reported.

Table 2: Victorian hospital peer grouping and number of responses

Hospital peer grouping (see Appendix 1)	Responses relating to policy	Responses relating to practice	Total	O RhD negative RBC units reported (adult and paediatric)
Principal referral hospitals	6	6	6	783 (766 and 17)
Public acute group A	15	15	15	673 (671 and 2)
Public acute group B	7	7	7	92
Public acute group C	20	18	20	155
Public acute group D	2	1	2	4
Mixed sub- & non-acute*	1	1	1	1
Other specialist overnight (public)*	4	3	4	189 (156 and 33)
Very small hospitals	1	0	1	0
Private acute group A	8	8	8	285
Private acute group B	7	7	7	177
Private acute group C	12	11	12	63
Private acute group D	8	8	8	36
Other specialist overnight (private)*	2	0	2	0
Total	**93**	**85**	**93**	**2,458 (2403 and 55)**

Groups marked with an asterisk (*) are not peer groups due to the diverse characteristics of the hospitals within the groups.

Agreement between algorithm and self-reported reason for selection of unit

There was a high agreement between algorithm output and health service reason given for selecting a group O RhD negative RBC unit (94 per cent). Of the 110 misalignments, 41 were marked as unknown by the health service. No health service disputed the preliminary data report and the allocated fate based on the algorithm.

Part 1: Survey on policy and inventory

Ninety-three Victorian health services responded to part 1 of the survey.

Policy

Five health services reported they did not have blood inventory held on site, and therefore had no policy. Another five health services did not hold inventory but reported a pathology policy. The following section applies to the 88 health services reporting inventories held either in the health service laboratory or a private pathology laboratory co-located or onsite.

To add background, there are a number of Victorian public hospitals serviced by contracted private pathology services, which may or may not be located on site. Victorian private hospitals may have more than one private pathology services providing blood products and again these may or may not be located on site or co-located.

The majority (80 of 88) of health services who reported holding an inventory of blood had at least one policy (either at the health service level and/or the pathology provider level) around the use of group O RhD negative and group O RhD positive RBC units in an emergency (see Table 3).

Table 3: Policies to conserve stock of group O RhD negative RBC units

Policy/guidance area	Number (%)
When to use emergency O RhD negative RBCs	79 (90%)
When to use O RhD positive RBCs in unknown blood groups	75 (85%)
When to provide O RhD positive RBCs in massive blood transfusion to O RhD negative females with no childbearing potential and adult males with no anti-D	68 (77%)

An important strategy to reduce product waste involves moving RBC units from smaller and more remote sites (spokes) to larger sites (hubs) where they are more likely to be used before they expire. Seventy-two per cent (n = 64) of responding health services reported having a policy regarding the requirement to rotate RBC units to prevent expiry. This varied from five to 16 days prior to the date of expiry, with 14 being the most common. To ensure RBC units can be used, they must be rotated with sufficient time before expiry.

Inventory

Ten health services reported not holding an inventory of any blood on site. Twenty-one (24 per cent) health services/laboratories stocked only group O RhD negative RBC units due to their small size and location. Their inventory ranged from one to 10 group O RhD negative units. Only eight (9 per cent) health services reported holding a stock of all blood groups. Total inventory size ranged from 82 to 384 units, with group O RhD negative RBC units making up 10 to 28 per cent of total inventory.

The remaining health services (n = 54) did not stock one or more blood groups (see Table 4).

Table 4: Health services not stocking all blood groups

Blood group not stocked	Number of health services not stocking specific blood group* (denominator n = 54)
Group A RhD negative	5 (9%)
Group B RhD negative	30 (55%)
Group B RhD positive	33 (61%)
Group AB RhD negative	48 (89%)
Group AB RhD positive	52 (96%)

** Excluding health services: with no inventory (n = 10), only stocking O RhD negative RBCs (n = 21) and holding all blood groups (n = 8).*

O RhD negative RBC as a proportion of inventory

There are currently no standards or guidelines in Australia providing what would be an acceptable percentage of O RhD negative RBC units to make up total inventory of a health service. However, such standards do exist in the United Kingdom, through the Blood Stocks Management Scheme, which requires hospitals to reduce their stock levels of O RhD negative RBCs to a level of 10.5 per cent (NHS National Survey). Table 5 shows that few health services reporting to the audit would meet this requirement.

Table 5: Health service/laboratory percentage stock of O RhD negative RBC units

Total inventory level (average holdings)	% stock O RhD negative RBC units	Number of health services
1–10 (3) RBC units	100–100% (median 100%)	21
11–50 (28) RBC units	14–66% (median 29%)	32
51–100 (72) RBC units	12–37% (median 18%)	18
> 100 (208) RBC units	10–28% (median 16%)	12

Part 2: Data on group O RhD negative RBC usage

Eighty-six Victorian health services reported on the movement (transfused, discarded or rotated) of at least one RhD negative RBC unit during November 2017.

Use of group O RhD negative RBC units against guidelines

It should be noted that this audit did not determine if the prescription of transfusion was appropriate, only if the blood group type selected met the guidelines for use of group O RhD negative RBC units.

Emergency indications for use

Use of group O RhD negative RBC units in an emergency is covered in the Blood Service guidelines under mandatory (in premenopausal females of unknown blood group) and acceptable (in an emergency while the patient's blood group is being established and should be limited to no more than two RBC units in most instances).

For the purpose of this report, when two RBC units were exceeded in an episode, all additional RBC units were allocated as not meeting guidelines. It should be noted that most massive transfusion protocols/packs in Victorian health services will consist of more than two emergency group O RhD negative RBC units.

In total, 223 of 2,035 (11 per cent) group O RhD negative RBC units were reported as transfused in an emergency during 111 episodes (1–8 units transfused per episode, mean 2.1). Total RBC units of all blood groups transfused during an emergency ranged from 1–15 (mean 3.3).

Eighty-eight episodes (transfusing a total of 140 units) met the mandatory and/or acceptable indications of use for O RhD negative RBC units in an emergency. The remaining 23 episodes exceeded the guideline limit of two units of group O RhD negative RBC, transfusing an additional of 83 units; with 42 units outside guidelines (see Table 6).

Table 6: Transfusion episodes that met emergency use criteria

Emergency episode category	Total transfusion episode only included O RhD negative RBC units Number of transfusion episodes (total O RhD negative RBC units) (range, average of total units per episode)	Total transfusion episode involved a switch to O RhD positive or recipient's own blood group Number of transfusion episodes (total O RhD negative RBC units) (range, average of total units per episode)
Premenopausal (< 50 years) females of unknown blood group (mandatory indication)	11 (24) (1–5, 2.3)	6 (11) (3–11, 5.7)
Transfusion episode limited to two or fewer group O RhD negative RBC units	42 (62) (1–2, 1.5)	29 (43) (2–10, 4.2)
Transfusion episode exceeded two units of group O RhD negative RBC	18 (62) (3–8, 4.0) (29 units transfused beyond recommended two)	5 (21) (5–15, 10) (13 units transfused beyond recommended two)

The guidelines recommend that 'in an emergency situation, Group O RhD negative RBC should be given while the patient's blood group is being established … and this can be limited to no more than two units in most instances. Once the patient's blood group has been determined, a switch to group specific blood should be made.'

It is important that specimens for blood grouping are collected and sent to the laboratory early to ensure the patient blood group can be determined, and the patient moved to the appropriate blood group as soon as possible. However, the ability to switch at two units is affected by the speed of blood loss, the ability to stem the bleeding, and the time to provide group specific blood, a real issue in trauma.

Mandatory indications for use

Group O RhD negative RBC units should **always** be given:

- in an emergency for premenopausal females of unknown blood group
- in group O RhD negative patients who:
  - have an anti-D antibody detected, or
  - are females with childbearing potential, or
  - are children (males and females < 16 years).

Overall, eight per cent (n = 170) of reported group O RhD negative RBC units were used for mandatory indications (Table 7).

Table 7: Mandatory indications for use

Mandatory indications for use	Number (%)
In emergency for premenopausal females of unknown blood group	35 (1.7%)
Group O RhD negative patients with anti-D	25 (1.2%)
Group O RhD negative females with childbearing potential	98 (4.8%)
Group O RhD negative children (males and females < 16 years)	12 (0.6%)
Total mandatory	**170 (8.3%)**

Recommended indications for use

Group O RhD negative RBC units **should** be transfused in group O RhD negative patients who will receive repeated transfusions, or are likely to become transfusion-dependent, for example, patients with hemoglobinopathies, aplastic anaemia, myelodysplasia (Table 8).

Overall, 13 per cent (n = 274) of reported group O RhD negative RBC units were used for this category.

Table 8: Recommended indication for use

Recommended indication for use	Number (%)
In group O RhD negative patients who will receive repeated transfusions, or are likely to become transfusion-dependent, for example, patients with hemoglobinopathies, aplastic anaemia, myelodysplasia	274 (13.4%)
Total recommended	**274 (13.4%)**

Acceptable indications for use

Group O RhD negative RBC units **may** be transfused in the following situations:

- in an emergency situation, group O RhD negative blood can be given while the patient's blood group is being established; this can be limited to no more than two RBC units in most instances
- if blood for neonatal use is required and suitable group specific RBCs are unavailable
- if the specific phenotyped blood provided is group O RhD negative.

Overall, 18 per cent (n = 360) of reported group O RhD negative RBC units were used for acceptable indications (Table 9).

Table 9: Acceptable indications for use

Acceptable indications for use	Number (%)
In an emergency situation, group O RhD negative RBCs can be given while the patient's blood group is being established	146 (7.2%)
If blood for neonatal use is required and suitable group specific red cells are unavailable*	–
If the specific phenotyped blood provided is group O RhD negative	214 (10. 5%)
Total acceptable	**360 (17.7%)**

**Paediatric units are considered separately for the purpose of this audit and report.*

To decrease the demand for group O RhD negative RBC units, the Blood Service is currently implementing a high-throughput phenotyping platform to increase the number of available phenotyped units across all ABO groups, rather than relying on phenotyped group O RhD negative RBC units.

This audit found a relatively low proportion of group O RhD negative RBC units were transfused to match a patient-specific phenotype – a total of 10 per cent (n = 214). Of these, 23 units were transfused to blood group O RhD negative recipients.

Data highlighted one outlier health service where 72 O RhD negative RBC units were allocated for transfusion for phenotype matching purposes (30 per cent). If this outlier is excluded, the rate would reduce to 6 per cent. Hirani et al. (2017) reported in 2015 that 16 per cent of O RhD negative RBC units were transfused due to a specific phenotype requirement or to meet cytomegalovirus (CMV) requirements. Our audit did not ask about CMV requirements.

Other generally acceptable indications for use

During the course of the data analysis, it became apparent that the Blood Service and NBTC (2008) guidelines did not explicitly cover the use of O RhD negative in group O RhD negative females with no childbearing potential, or group O RhD negative adult males with no anti-D antibody detected. However, the Blood Service does advocate the use of identical ABO and RhD group as the recipient for red cell transfusion whenever possible. <https://transfusion.com.au/blood_products/components/red_cells/use>. To address this, a new subcategory of indications of use called 'generally acceptable' was created.

The use of group O RhD negative in patients with mismatched stem-cell transplant recipients was also created as a subcategory under 'generally acceptable', as transplant protocols often require transfusion of group O RBCs to reduce compatibility issues between donor and recipient.

Overall, 24 per cent (n = 493) of reported group O RhD negative RBC units fit generally acceptable indications (Table 10).

Table 10: Generally acceptable indications for use

Generally acceptable indications for use	Number (%)
Group O RhD negative females with no childbearing potential with no anti-D antibody detected Group O RhD negative males with no anti-D antibody detected	431 (21.2%)
Mismatched stem-cell transplant recipients	62 (3.0%)
Total generally acceptable	**493 (24.2%)**

Adequate stock management policy

Although rotated group O RhD negative RBC units will ultimately be used or discarded, we collected information about rotation because it is an important strategy to ensure equitable access to product, yet reduce potential wastage. Rotation of blood products is a common strategy used across Victoria to reduce the potential for waste.

Typically, smaller, regional health services/laboratories will develop a rotation agreement with larger health services/laboratories where the patient group is larger, more varied, and more likely to utilise the product before expiry.

Transfers of group O RhD negative RBC units may occur on some occasions when a patient is being transferred to another health service for a higher level of care, and/or where specifically requested by Ambulance Victoria medical staff for patient safety, that blood should accompany them.

Specific definitions of transfer and rotation were provided in the audit instructions, although data suggests that this may not have been responded to consistently. The definition did not distinguish between O RhD negative RBC units rotated from a hub site to a spoke site, or to support Air Ambulance Victoria [four sites] (see Table 11).

Table 11: Rotation and transfer of group O RhD negative RBC stock

Peer group	Rotation (%)	Transfer (%)	Rotation + transfer (%)
Principal referral	0%	3%	3%
Public A	5%	12%	17%
Public B	29%	12%	41%
Public C	50%	0%	50%
Private A	2%	8%	11%
Private B	21%	7%	28%
Private D	6%	28%	33%
All reporting health services	8%	7%	15%

Overall, 368 rotation and transfer movements for 353 unique units were reported during the period of November. Of these units, 127 had a final fate reported during November (see Table 12), with 46 per cent (n = 59) being transfused appropriately against guidelines and 37 per cent (n = 47) being transfused to prevent time expiry. Only three units were reported as discarded.

Larger health services/laboratories (hubs) receiving rotated product must take into consideration all product entering their inventory (that is, product received from suppliers plus product rotated in from other health services/laboratories) when ordering blood. In addition, spokes rotating product out must ensure there is adequate time before expiry to allow for the unit to be used appropriately.

Table 12: Ultimate fate of rotated units

Use	Unique RBC units with reported rotation/transfer and subsequent fate* (%)
Mandatory indications for use	4 (3.1%)
Recommended indications for use	15 (11.8%)
Acceptable indications for use	12 (9.4%)
Generally acceptable indications for use	28 (22.0%)
Perceived clinical need (special requirement, exceeded use of 2 emergency O neg units)	–
Inventory management issues (used to prevent time expiry, stock not held in inventory, insufficient stock)	54 (42.5%)
Other reasons for use outside the guidelines/unknown	11 (8.6%)
Discards	3 (2.4%)
Fate (transfusion or discard) not reported for November	223
Total	**350**

** Denominator = 127 based on units with a known fate. Additional 18 reports not included in fate of rotated/transferred RBC units, due to being duplicate RBC units reported on with multiple movements.*

Other reasons given for use not covered in guidelines

Health services/laboratories also reported selection of group O RhD negative RBC units based on other reasons outside of the guidelines. As shown in Table 13, these can be broken down to perceived clinical need, inventory management issues or other/unknown.

Table 13: Reasons given for use outside of the guidelines

Other reasons given for selection of RBC unit	Number (%)
Perceived clinical need	
Special requirement (e.g. CMV negative)	48 (2.4%)
Exceeded use of two emergency O neg units	42 (2.1%)
Inventory management	
To prevent time expiry	337 (16.6%)
Patient-specific blood group not held in inventory	80 (3.9%)
Insufficient stock	55 (2.7%)
Other reasons/unknown	88 (4.3%)
Total use outside of the guidelines	**650 (31.9%)**

Discards

Four per cent (n = 88) group O RhD negative RBC units were reported as discarded in November 2017. The majority (n = 54, 2.6 per cent) was due to time expiry.

Summary of how group O RhD negative RBC units are used

Overall, 64 per cent (1,297 of 2035) of group O RhD negative RBC units were selected and used according to guidelines (Table 14). However, 36 per cent (738/2035) reached a questionable fate, with the largest proportion of group O RhD negative RBC units being used to prevent time expiry (16.6 per cent, n = 337) (see Table 13).

Table 14: Summary – indications for selection of group O RhD negative RBC unit

Use	Number (%)
Mandatory indications for use	170 (8.3%)
Recommended indications for use	274 (13.4%)
Acceptable indications for use	360 (17.7%)
Generally acceptable indications for use	493 (24.2%)
Perceived clinical need (special requirement, exceeded use of two emergency O neg units)	90 (4.4%)
Inventory management issues (used to prevent time expiry, stock not held in inventory, insufficient stock)	472 (23.2%)
Other reasons for use outside the guidelines/unknown	88 (4.3%)
Discards	88 (4.3%)
Total	**2,035**

Variability in use

The audit showed that the fate of group O RhD negative RBC units varied across health services and within peer groups. For example, principal referral health services had a range of 45–86 per cent (mean 74 per cent) of RBC units being used within the guidelines. Appendix 2 provides more details on the variability across health services.

Paediatric units

An adult-size red-blood cell unit is divided into four packs of equal volume to create paediatric packs suitable for small-volume paediatric transfusions, to reduce donor exposure and to minimise product wastage. The four packs are generally kept together and, when required, all (or at least two units) may be reserved for one recipient, so if repeated transfusions are required, packs from the same donation can be used to reduce donor exposure.

Health services reported on 55 paediatric units, from 24 donations. At least one pack from each donation was reported as transfused, except in one, where all packs were discarded as expired (Table 15).

Table 15: Indications for selection of paediatric group O RhD negative RBC units

Use	Number (%)
Mandatory indications for use	4 (7.3%)
Recommended indications for use	–
Acceptable indications for use	33 (60.0%)
Generally acceptable indications for use	–
Perceived clinical need (special requirement, exceeded use of 2 emergency O neg units)	–
Inventory management issues (used to prevent time expiry, stock not held in inventory, insufficient stock)	–
Other reasons for use outside the guidelines/unknown	–
Discards	18 (32.7%)
Total	**55**

Discussion

From 2011 to 2017, there was an increase (19 per cent) in group O RhD negative RBC units issued across Victoria. This audit reports that a significant proportion (36 per cent) of all group O RhD negative RBC units were transfused to recipients outside the *Guidelines for the use of group O RhD negative red cells* (Blood Service and NBTC 2008).

The frequency of this transfusion practice varies greatly across health services. The most common reason (n = 337, 17 per cent) for transfusing group O RhD negative RBC units to non-identical recipients was to prevent expiry. This, to some extent, is avoidable and relates more to inventory management than to transfusion policy or clinical need. The second most common reason (n = 223, 11 per cent) was transfused in an emergency situation when recipient blood group was unknown. Of these, 181 were within the guidelines' indications of use, and 42 were outside indications of use.

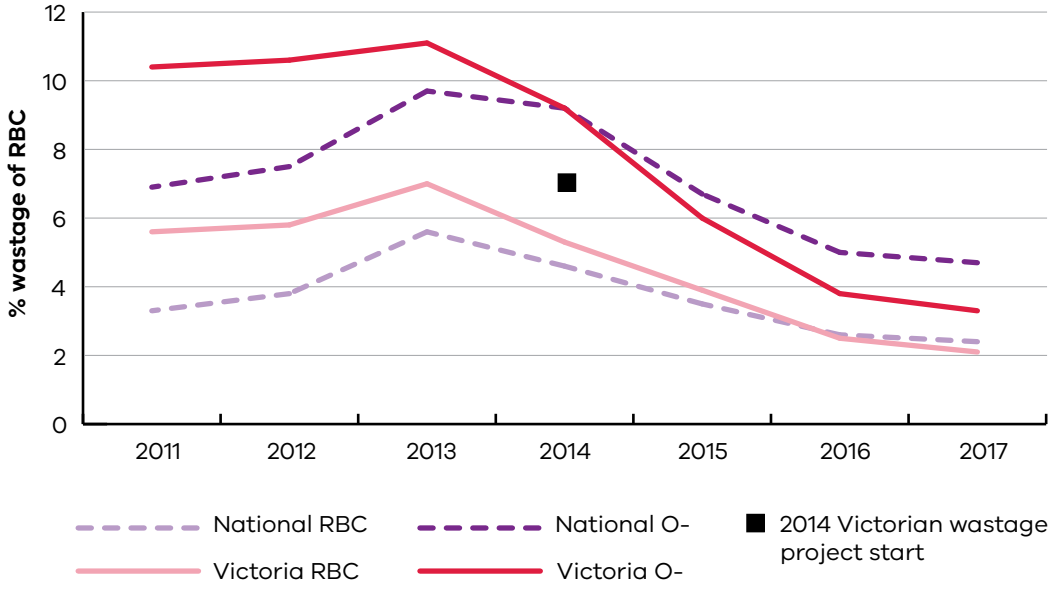
Although group O RhD negative RBC is considered 'universal', some retrospective studies question the safety of providing compatible, non-identical RBC transfusions. Pai et al. (2016) reviewed 18,843 non-group O inpatients, and found an increased mortality among the group A patients who received compatible but non-identical blood compared with patients who received group-identical blood.

The UK's 2010 National Comparative Audit (UK) of O RhD Negative usage determined that the rate of mismatched transfusion to avoid time expiry (10 per cent) was too high. To address this, a recommendation was made that hospitals must reduce their stock levels of group O RhD negative RBCs to a level of 10.5 per cent in order to avoid transfusions to non-group O RhD negative patients and thus avoid wastage due to time expiry. This is supported through the UK Blood Stocks Management Scheme.

Much has been done to prevent wastage across Australia for all blood groups as part of the *National blood and Blood Product Wastage Reduction Strategy 2013–17* (NBA, 2013). Victoria has been successful in this area, reducing its RBC wastage from 5.6 per cent in 2011 to 2.1 per cent in 2017 (10.4 per cent to 3.3 per cent for group O RhD negative units). Hirani et al. (2017) reported an overall national discard rate of O RhD negative units for February 2015 at 8 per cent (6 per cent due to expiry).

The discard rate for this audit showed a reduction in November 2017 to 4.4 per cent (2.8 per cent due to expiry). Successes from these blood management initiatives may have, however, inadvertently pushed up the demand of group O RhD negative RBCs.

Figure 3: RBC wastage 2011–2017



It was noted that some health services stopped holding a full inventory to reduce waste, resulting in use of group O RhD negative RBC units for patients with other groups, which is perhaps unnecessary when matched units can be ordered. Additionally, group O RhD negative RBC units are being electively transfused to non-group O RhD negative recipients to prevent time expiry.

This use of group O RhD negative units is not encouraged and is addressed in the Blood Service guidelines (2008), which state that 'adequate stock management policies should be in place to minimise wastage of group O RhD negative red cells arising from time expiry, and to avoid the need to electively transfuse to non-group O recipients to prevent time expiry, as well as that adequate stocks of other blood groups should be maintained by hospitals to avoid the unnecessary use of group O RhD negative blood for patients with other groups.'

Inventory management is a complex balance between holding enough blood and limiting waste. This becomes more complicated when a health service/laboratory may be a hub for regional spokes which rotate group O RhD negative RBC units back to the hub before expiry (an encouraged practice) in order to reduce the likelihood of the unit being discarded due to time expiry. The results of this audit indicated that some hubs had difficulty absorbing the rotated group O RhD negative RBC units, and these were ultimately used in non-group O RhD negative patients to prevent time-expiry wastage. Transfusion of these units to prevent time expiry must be regarded as an inappropriate use of this blood group, and as such should be considered as waste. Inventory review is suggested, as supported by the UK Blood stocks management <http://www.bloodstocks.co.uk/pdf/where-do-all-o-negative-red-cells-go.pdf>.

Overall, the audit results show little clinical need associated with the increase in group O RhD negative RBC units, and improved inventory management needs to be addressed to reduce the burden placed on donors.

With recurrent shortfalls and increasing demand for group O RhD negative RBCs, donor management practices are focused on inviting group O negative blood donors to donate more regularly. To date, these donor management practices have enabled successful retention of group O RhD negative blood donors (Gemelli et al. 2017). However, further enhancements of group O RhD negative collections would be both difficult and costly (Blood Service 2008).

It is imperative that group O RhD negative RBC units are:

- available for patients who have no alternative, when required
- distributed in a manner allowing equitable access
- used responsibly, sustainably and respecting donor welfare.

Audit recommendations

Blood Matters

- Disseminate data to key stakeholders (Victorian health services/pathology providers, National Blood Transfusion Committee, the Blood Service, and National Blood Authority).
- Request the National Blood Transfusion Committee and the Blood Service review the Guidelines for the use of group O RhD negative red cells (Blood Service and NBTC 2008).
- Increase health service/laboratory awareness of the *Guidelines for the use of group O RhD negative red cells* (Blood Service and NBTC 2008).
  - Develop tools to assist with education.
- With the Department of Health and Human Services and the Blood Service, develop a process to provide individual health service/pathology provider support and guidance to align with guidelines, for example, for hub and spoke sites and high level of use, to prevent time expiry
  - Develop tools (as required) to support.
- Make audit tools available for health services/laboratories to re-audit.

At the health service/pathology provider level

- Review individual results with the blood management or transfusion committee to develop strategies for improvement where required.
- Review laboratory inventory levels where indicated.
- Work towards a process for laboratory information systems to include flags to indicate close to expiry, or time to rotate (where hub and spoke models used).
- Explore options to interface laboratory information systems with BloodNet to allow inventory visibility of all blood products.
- Encourage regular discussions with the Blood Service about inventory and proportion of O RhD negative RBC inventory.
- Re-audit to measure success of any practice changes as a result of the original audit results.

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Appendix 1: Hospital peer groups

Hospital peer groupings define groups of similar hospitals based on shared characteristics, and allow a better understanding of the organisation and provision of hospital services. When presenting and analysing health performance and other information, it is important that valid comparisons are able to be made. For hospitals, a peer grouping supports comparisons that reflect the purpose, resources and role of each hospital.

In developing the peer groups, the Australian Institute of Health and Welfare (AIHW) was advised that public and private acute hospitals are not directly comparable, and consequently different peer groupings were created. See the AIHW website for more information <https://www.aihw.gov.au/reports/hospitals/australian-hospital-peer-groups/contents/table-of-contents>.

Peer group	Definition
Principal referral hospitals	These are public acute hospitals that provide a very broad range of services, have a range of highly specialised service units, and have very large patient volumes. The term 'referral' recognises that these hospitals have specialist facilities not typically found in smaller hospitals.
Public acute group A hospitals	These are public acute hospitals that provide a wide range of services typically including a 24-hour emergency department, intensive care unit, coronary care unit and oncology unit, but do not provide the breadth of services provided by principal referral hospitals.
Public acute group B hospitals	These are those public acute hospitals that do not have the service profile of the principal referral hospitals and group A hospitals, but do have a 24-hour emergency department. They typically provide elective surgery and have specialised service units such as obstetric, paediatric and psychiatric units.
Public acute group C hospitals	These include those public acute hospitals that provide a more limited range of services than principal referral hospitals or public acute group A and B hospitals, but do have an obstetric unit, provide surgical services and/or some form of emergency facility (emergency department, or accident and emergency service).
Public acute group D hospitals	These are acute public hospitals that offer a smaller range of services relative to the other public acute hospital groups, and provide 200 or more separations per year. They are mostly situated in regional and remote areas.
Private acute group A hospitals	These are private acute hospitals that have a 24-hour emergency department and an intensive care unit, and provide a number of other specialised services such as coronary care, special care nursery, cardiac surgery and neurosurgery.

Peer group	Definition
Private acute group B hospitals	These are private acute hospitals that do not have a 24-hour emergency department, but do have an intensive care unit and a number of other specialised services including coronary care, special care nursery, cardiac surgery and neurosurgery.
Private acute group C hospitals	These are those private acute hospitals that do not provide emergency department services or have an intensive care unit, but do provide specialised services in a range of clinical specialities.
Private acute group D hospitals	These are those private acute hospitals that do not provide emergency department services or have an intensive care unit, do not provide specialised services in a range of clinical specialities, but had 200 or more separations.
Specialist overnight hospitals	These are public and private hospitals that provide care on a same day and overnight basis to a specific target population or group of conditions. Subgroups include: children's hospitals and women's hospitals. The overarching peer group cannot be grouped as such for comparisons due to the diverse characteristics of the hospitals.
Sub- and non-acute hospitals	These are hospitals that provide mostly sub- and non-acute care (for example, rehabilitation, palliative care, geriatric care) on a same day and overnight basis. Sub- and non-acute hospitals were identified where: • over 70 per cent of separations were sub- and non-acute separations, or • over 70 per cent of patient days were sub- and non-acute days and over 50 per cent of separations were sub- and non-acute separations.
Very small hospitals	These have few beds and provide care for few admitted patients. Most do not perform surgery.

Appendix 2: Appropriate use of group O RhD negative red blood cells by peer group

Summary audit results for public hospitals

	Principal referral	Public group A	Public group B	Public group C
Number of group O RhD negative units transfused or discarded	52–233 (124)	5–85 (35)	1–14 (7)	1–13 (7)
	% range (% mean)	% range (% mean)	% range (% mean)	% range (% mean)
Mandatory				
Group O RhD negative patients with anti-D	0–2.9 (1.3)	0–20.0 (1.1)	0–100.0 (7.8)	0 –0 (0)
Group O RhD negative females with childbearing potential	0–24.1 (6.6)	0–20.0 (2.3)	0–100.0 (7.8)	0–25.0 (2.6)
In emergency to premenopausal (<50 years) females of unknown blood group	0–2.9 (0.8)	0–16.9 (3.6)	0–14.3 (3.9)	0–0 (0)
Group O RhD negative children (males & females < 16 years)	0–3.4 (0.5)	0–0 (0)	0–0 (0)	0–0 (0)
Recommended				
Group O RhD negative patients who will receive repeated transfusions, or are likely to become transfusion-dependent. (For example: patients with hemoglobinopathies, aplastic anaemia, myelodysplasia)	3.4–26.7 (11.4)	0–35.0 (10.4)	0–9.1 (2.0)	0–100.0 (24.4)

	Principal referral	Public group A	Public group B	Public group C
	% range (% mean)	% range (% mean)	% range (% mean)	% range (% mean)
Acceptable				
In an emergency situation, group O RhD negative blood should be given while the patient's blood group is being established	0–18.2 (11.6)	0–21.7 (6.6)	0–0 (0)	0–0 (0)
If blood for neonatal use is required and suitable group specific red cells are unavailable	–	–	–	–
If the specific phenotyped blood provided is group O RhD negative	0–30.9 (16.6)	0–33.3 (8.3)	0–14.3 (2.0)	0–25.0 (2.6)
Generally Acceptable				
In group O RhD negative females with no childbearing potential and adult males who do not have an existing or historical anti-D in larger volume blood replacement (e.g. more than 6–10 units of blood)	0–6.0 (0.9)	0– 0 (0)	0–50.0 (11.8)	0– 0 (0)
In group O RhD negative female patients with no childbearing potential and unimmunised males, with no anti-D detected on pretransfusion testing.	7.3–50 (18.4)	0–63.6 (20.5)	0–100.0 (25.5)	0– 3.3 (9.0)
In ABO mismatched haemopoietic patients	0–12.0 (5.2)	0–0 (0)	0–0 (0)	0–0 (0)
Total number meeting indications for use	**44.7–86.1 (73.5)**	**0–83.3 (52.8)**	**27.3–100 (60.8)**	**0–100 (38.5)**

	Principal referral	Public group A	Public group B	Public group C
	% range (% mean)	% range (% mean)	% range (% mean)	% range (% mean)
Other reasons for use of O RhD negative unit				
Insufficient stock	0–3.8 (1.1)	0–8.0 (1.8)	0–14.3 (2.0)	0–7.7 (1.3)
Patient blood group not held in inventory	0–4.3 (1.3)	0–13.3 (2.0)	0–33.3 (9.8)	0–100.0 (26.9)
Special requirements (besides phenotypes), e.g. CMV negative	0–22.3 (4.3)	0–21.4 (2.5)	0–0 (0)	0–0 (0)
Used to prevent time expiry	5.2–28.7 (12.2)	0–52.5 (28.7)	0–36.4 (21.6)	0–100.0 (21.8)
Exceeded use of two emergency units	0–5.2 (3.4)	0–9.1 (1.6)	0–9.1 (2.0)	0–0 (0)
Other/Unknown	0–6.9 (2.2)	0–46.7 (3.9)	0–0 (0)	0–46.2 (7.7)
Discards				
Expired	0–1.3 (0.4)	0–36.4 (3.6)	0–18.2 (3.9)	0–100.0 (2.6)
Clinical	0–0 (0)	0–4.9 (0.4)	0–0 (0)	0–0 (0)
Storage/damage	0–3.2 (1.6)	0–8.7 (2.7)	0–0 (0)	0–11.1 (1.3)
Total units outside guidelines	**13.9–55.3 (26.5)**	**16.7–100 (47.2)**	**0–72.7 (39.2)**	**0–100.0 (61.5)**
Total number of group O RhD negative units transfused, discarded, rotated, or transferred	52–250 (128)	5–85 (42)	2–31 (13)	2–17 (9)
Adequate stock management principles				
Rotation	0–0 (0)	0–55.2 (4.6)	0–77.4 (30.3)	0–100 (49.7)
Transferred	0–6.8 (3.0)	0–51.9 (12.4)	0–90.0 (12.4)	0–0 (0)

Summary audit results for private hospitals

	Private group A	Private group B	Private group C	Private group D
Number of group O RhD negative units transfused or discarded	8–55 (32)	5–33 (18)	1–12 (5)	0–12 (3)
	% range (% mean)	% range (% mean)	% range (% mean)	% range (% mean)
Mandatory				
Group O RhD negative patients with anti-D	0–0 (0)	0–0 (0)	0–0 (0)	0–0 (0)
Group O RhD negative females with childbearing potential	0–6.3 (0.8)	0–0 (0)	0–0 (0)	0–0 (0)
In emergency to premenopausal (<50 years) females of unknown blood group	0–0 (0)	0–0 (0)	0–50.0 (22.7)	0–0 (0)
Group O RhD negative children (males & females < 16 years)	0–0 (0)	0–0 (0)	0–0 (0)	0–0 (0)
Recommended				
Group O RhD negative patients who will receive repeated transfusions, or are likely to become transfusion-dependent. (For example: patients with hemoglobinopathies, aplastic anaemia, myelodysplasia)	0–47.2 (22.0)	0–47.8 (22.0)	0–50.0 (22.7)	0–100.0 (37.5)
Acceptable				
In an emergency situation, group O RhD negative blood should be given while the patient's blood group is being established	0–12.5 (3.1)	0–60.0 (5.5)	0–100.0 (11.4)	0–100.0 (8.3)
If blood for neonatal use is required and suitable group specific red cells are unavailable	–	–	–	–
If the specific phenotyped blood provided is group O RhD negative	0–19.0 (7.8)	0–21.4 (2.4)	0–0 (0)	0–100.0 (12.5)

	Private group A	Private group B	Private group C	Private group D
	% range (% mean)	% range (% mean)	% range (% mean)	% range (% mean)
Generally Acceptable				
In group O RhD negative females with no childbearing potential and adult males who do not have an existing or historical anti-D in larger volume blood replacement (e.g., more than 6–10 units of blood)	0–0 (0)	0–0 (0)	0–0 (0)	0–0 (0)
In group O RhD negative female patients with no childbearing potential and unimmunised males, with no anti-D detected on pretransfusion testing.	3.6 –50.9 (29.8)	20.0–76.9 (40.9)	0–100.0 (11.4)	0–100.0 (8.3)
In ABO mismatched haemopoietic patients	0–0 (0)	0–0 (0)	0–0 (0)	0–0 (0)
Total number meeting indications for use	**25.0–97.6 (63.5)**	**51.5–100.0 (70.9)**	**0–100.0 (50.0)**	**25.0–100.0 (66.7)**
Other reasons for use of O RhD negative unit				
Insufficient stock	0–67.9 (9.4)	0–0 (0)	0–0 (0)	0–0 (0)
Patient blood group not held in inventory	0–28.1 (5.5)	0–48.5 (12.6)	0–0 (0)	0–0 (0)
Special requirements (besides phenotypes), e.g. CMV negative	0–0 (0)	0–0 (0)	0–0 (0)	0–0 (0)
Used to prevent time expiry	0–62.5 (11.8)	0–21.4 (2.4)	0–100.0 (15.9)	0–25.0 (12.5)
Exceeded use of two emergency units	0–6.3 (0.8)	0–0 (0)	0–45.5 (11.4)	0–0 (0)
Other/Unknown	0–23.7 (6.7)	0–30.4 (5.5)	0–33.3 (9.1)	0–25.0 (12.5)
Discards				
Expired	0–12.5 (2.0)	0–47.6 (8.7)	0–100 (13.6)	0–50.0 (8.3)
Clinical	0–0 (0)	0–0 (0)	0–0 (0)	0–0 (0)
Storage/damage	0–2.8 (0.4)	0–0 (0)	0–0 (0)	0–0 (0)
Total units outside guidelines	**2.4–75.0 (36.5)**	**0–48.5 (29.1)**	**0–100.0 (50.0)**	**0–75.0 (33.3)**

	Private group A	Private group B	Private group C	Private group D
Total number of group O RhD negative units transfused, discarded, rotated, or transferred	8–59 (36)	9–36 (22)	1–12 (6)	2–12 (5)
	% range (% mean)	% range (% mean)	% range (% mean)	% range (% mean)
Adequate stock management principles				
Rotation	0–23.8 (2.1)	0–62.3 (21.5)	0–100 (30.2)	0–50.0 (5.6)
Transferred	0–28.8 (8.4)	0–44.4 (6.8)	0–0 (0)	0–100.0 (27.8)

	Other specialised (public)	All responding health services
Number of group O RhD negative units transfused or discarded	5–83 (52)	0–233 (60)
	% range (% mean)	% range (% mean)
Mandatory		
Group O RhD negative patients with anti-D	0.0–100.0 (3.2)	0.0–100.0 (1.2)
Group O RhD negative females with childbearing potential	0.0–31.3 (18.1)	0.0–100.0 (4.8)
In emergency to premenopausal (<50 years) females of unknown blood group	0.0–7.5 (3.2)	0.0–33.3 (1.7)
Group O RhD negative children (males & females < 16 years)	0.0–11.9 (5.2)	0.0–11.9 (0.6)
Recommended		
Group O RhD negative patients who will receive repeated transfusions, or are likely to become transfusion-dependent. (For example: patients with hemoglobinopathies, aplastic anaemia, myelodysplasia)	0.0–9.6 (5.2)	0.0–100.0 (13.5)
Acceptable		
In an emergency situation, group O RhD negative blood should be given while the patient's blood group is being established	0.0–1.5 (0.6)	0.0–100.0 (7.2)
If blood for neonatal use is required and suitable group specific red cells are unavailable	–	–
If the specific phenotyped blood provided is group O RhD negative	0.0–11.9 (10.3)	0.0–100.0 (10.5)
Generally Acceptable		
In group O RhD negative females with no childbearing potential and adult males who do not have an existing or historical anti-D in larger volume blood replacement (e.g., more than 6–10 units of blood)	0–0 (0)	0.0–50.0 (0.6)

	Other specialised (public)	All responding health services
	% range (% mean)	% range (% mean)
In group O RhD negative female patients with no childbearing potential and unimmunised males, with no anti-D detected on pretransfusion testing.	0.0–9.6 (7.1)	0.0–100.0 (20.5)
In ABO mismatched haemopoietic patients	0.0–19.3 (14.8)	0.0–19.3 (3.0)
Total number meeting indications for use	**56.6–100.0 (67.7)**	**0.0–100.0 (63.7)**
Other reasons for use of O RhD negative unit		
Insufficient stock	0.0–9.0 (7.1)	0.0–67.9 (2.7)
Patient blood group not held in inventory	0.0–3.6 (1.9)	0.0–100.0 (3.9)
Special requirements (besides phenotypes), e.g. CMV negative	0.0–3.0 (1.3)	0.0–22.3 (2.4)
Used to prevent time expiry	0.0–18.1 (9.7)	0.0–100.0 (16.6)
Exceeded use of two emergency units	0–0 (0)	0.0–45.5 (2.1)
Other/Unknown	0.0–15.7 (8.4)	0.0–46.7 (4.3)
Discards		
Expired	0.0–4.5 (1.9)	0.0–100.0 (2.7)
Clinical	0.0–3.0 (1.3)	0.0–5.0 (0.2)
Storage/damage	0.0–1.5 (0.6)	0.0–11.1 (1.5)
Total units outside guidelines	**0.0–43.4 (32.3)**	**0.0–100.0 (36.3)**
Total number of group O RhD negative units transfused, discarded, rotated, or transferred	**5–83 (52)**	**1–250 (70)**
Adequate stock management principles		
Rotation	0–0 (0)	0.0–100.0 (8.5)
Transferred	0.0–1.5 (0.6)	0.0–100.0 (6.8)