

Collected in November 2017

What is this research about?

Maintaining a sufficient inventory of blood products for patients in need is of critical importance. The supply of Type O red blood cells is especially important because these “universal donor” products can be safely transfused to patients of any ABO blood type. This makes Type O red blood cells critical for emergency transfusions when the recipient’s blood type is unknown, or if there is an insufficient supply of ABO-matched blood products available for a patient in need.

Health-care providers have implemented patient blood management (PBM) strategies to reduce the transfusion of blood products while optimizing patient care. These strategies include preventative treatments that can reduce the need for transfusion and improved techniques to reduce and recover blood lost during surgery. PBM and other initiatives that are aimed at improving transfusion practice and blood product inventory management are delivering better patient care while saving costs to the blood system. However, some inventory management strategies increase the complexity in forecasting demand and may cause inventory shortages, especially for Type O blood products.

Researchers are studying the distribution and utilization of red blood cells in order to provide the evidence that blood operators and hospitals need to make informed decisions in inventory management and transfusion practice. Ultimately, this ensures that any patient at any time can receive the blood product that they need.

What did the researchers do?

In the Trends for Collection (TFC) study, researchers looked at red blood cell distribution to hospitals from blood centres worldwide over five fiscal years (July 2009 to June 2014). Data from seven U.S. blood centres were combined and compared to data from eight other blood centres including two from Canada. In the GRoup O Utilization Patterns (GROUP) study, researchers surveyed hospitals in 11 countries to understand their overall Type O blood utilization. In a third study, Canadian researchers focused on Type O red blood cell utilization at three hospitals to analyse utilization trends in more detail. For each transfusion, the researchers used the hospital database to identify the blood types of the donor and recipient, the medical cause of the transfusion, and whether the recipient had other red blood cell antibodies which require more extensively-matched (“phenotyped”) blood products. When Type O red blood cells were transfused to recipients with blood types A, B or AB, the researchers used an algorithm to identify the reason for using a Type O product.

What did the researchers find?

- ◆ In the TFC study, the number of distributed red blood cell units steadily decreased over the five years in both groups (16.9 per cent decrease in U.S. centres and 8 per cent elsewhere). However, the proportion of distributed Type O-negative units increased by 9.3 per cent in U.S. blood banks and by 10.5 per cent elsewhere.
- ◆ The GROUP study showed that a large percentage of O-negative blood products are used for patients who are not O-negative. Interestingly, this percentage varied among different sites.
- ◆ The Canadian study found that the proportion of Type O red blood cell units transfused to non-Type O recipients has increased, from 7.8 per cent in 2002–2007 to 11.1 per cent in 2011–2013. The most common reasons for transfusing Type O blood to non-Type O recipients were patients who required phenotyped blood (28 per cent), hospital inventory shortages of ABO-identical products (26 per cent), transfusions for newborns (23 per cent), and trauma patients (10 per cent). The recent increase was due to greater use in trauma patients and inventory management (hospital shortages of ABO-identical products and preferentially using older units to prevent waste).

In brief...

While the overall red blood cell use is decreasing, the proportion of Type O products used is increasing, particularly for non-Type O recipients.

How can you use this research?

Blood operators and blood banks must monitor shifts in red blood cell use to accurately predict future use and maintain an adequate supply of blood products. Although the overall decrease in red blood cell distribution shown in the TFC study suggests that blood operators may need to decrease their donor recruitment, the increased proportion of Type O-negative blood products used makes inventory management more complex. Attention will need to be given to the blood type of distributed red blood cells in order to manage the inventory while maintaining costs at a minimum. In addition, because the reasons for the change in red blood cell utilization are multifaceted (e.g. changes in hospital inventory management, changes in transfusion practice, changes in patient populations), blood operators will need to monitor the changing trends closely to ensure adequate capacity is maintained to respond to future shifts in demand.

Clinical guidelines and best practices to optimize Type O red blood cell utilization may be lacking. The GROUP study showed that a large percentage of O-negative blood products are used for patients who are not O-negative. Interestingly, this percentage varied at different sites, suggesting that hospitals with higher use of O-negative blood might be able to alter their policies to decrease non-essential use of this precious resource.

The Canadian study provided some answers to the reasons behind the increased proportion of Type O products used. At the three hospital sites examined, the use of Type O blood products for non-Type O patients has increased in the last few years, mainly due to increased use in trauma patients and local inventory challenges. Three-quarters of the Type O blood products transfused to non-Type O patients were used for patients with antibodies, newborns, and patients who did not have ABO-matched blood available. Thus, hospitals that use Type O blood for all newborns, or for all patients with antibodies, could reduce the risk of Type O product shortages by changing these policies, without altering the safety of the blood products. In addition, blood operators should ensure that a wide range of units from every blood group are phenotyped to accommodate hospitals' demand for group specific (A, B, AB) phenotyped red blood cells.

Other studies have recently suggested that patients may have better outcomes when transfused with ABO-identical blood. Reducing the transfusion of Type O blood products to non-Type O recipients could not only improve inventory management but also directly improve patient health.

About the research teams: The TFC study was performed by the Biomedical Excellence for Safer Transfusions (BEST) Collaborative, including **Dr. Dana Devine**, Canadian Blood Services chief medical and scientific officer and professor in the department of pathology and laboratory medicine at the University of British Columbia. The senior author of the Canadian study, **Prof. Nancy Heddle**, is a professor emeritus in the department of medicine at McMaster University, the research director of the McMaster Centre for Transfusion Research, and an adjunct scientist at Canadian Blood Services. The first author, R. Barty, is a graduate student working with Prof. Heddle. Other authors include Dr. M. Pai, Y. Liu, Dr. D. Arnold, Dr. R. Cook, and **Dr. Michelle Zeller**, a Canadian Blood Services medical officer. The GROUP study was led by **Dr. Zeller**, in collaboration with **Prof. Heddle** and other members of the BEST Collaborative.

This ResearchUnit is derived from the following publications:

1. Yazer MH, et al., on behalf of the BEST Collaborative. Changes in blood center red blood cell distributions in the era of patient blood management: The trends for collection (TFC) study. *Transfusion* 2016; 56: 1965-73.
2. Barty RL, et al. Group O RBCs: Where is universal donor blood being used. *Vox Sang* 2017.
3. Zeller MP, et al. An international investigation into O red blood cell unit administration in hospitals: the GRoup O Utilization Patterns (GROUP) study. *Transfusion* 2017; 57: 2329-37.

Acknowledgements: These research projects received direct or indirect funding support from Canadian Blood Services' Centre for Innovation, funded by the federal government (Health Canada) and the provincial and territorial ministries of health. The views herein do not necessarily reflect the views of the federal, provincial, or territorial governments of Canada. Canadian Blood Services is grateful to the blood donors and patients who made this research possible.

Keywords: red blood cells, patient blood management, ABO blood type, Type O, distribution, utilization

Want to know more? Contact Dr. Michelle Zeller at Michelle.Zeller@blood.ca or Dr. Dana Devine at Dana.Devine@blood.ca.