



# DRIVING GOOD STEWARDSHIP THROUGH PATIENT BLOOD MANAGEMENT

By Jennifer Rhamy, MBA, MA, MT(ASCP)SBB, HP

St. Mary's Regional Blood Donor Center

Patient Blood Management (PBM) is usually discussed, rightfully, in terms of patient benefit. A comprehensive program should also be designed to improve the care of the patient in ways that promote best practices and discourages waste. According to the AABB Standards for Blood Banks and Transfusion Services, transfusing facilities shall have a peer-review program assessing the stewardship practices that are part of utilization management, including transfusion decisions.<sup>1</sup> These stewardship requirements include ordering practices, sample identification and collection, and wastage.

## INVENTORY MANAGEMENT

According to AABB,<sup>2</sup> an estimated 38% of the US population is eligible to donate blood, but less than 10% actually do so. The O-negative blood type represents approximately 7-9% of the blood donor population, but O-negative units account for 11% of all transfusions.<sup>3</sup> Extrapolating these percentages, only about 0.3% of the US population is O-negative and a blood donor. The latest National Blood Collection and Utilization Survey found that red blood cell (RBC) collections declined 11.6% in 9 years and transfusions decreased 13.9%.<sup>4</sup> While this is good news in terms of utilization and donor recruitment, the decrease in overall red cell supply, combined with the continued reliance on O-negative units, places significant inventory management concerns on blood centers and transfusion services alike.

As the overall need declines, one of two things can happen. Hospitals may order fewer units from the blood center and require a higher percentage of O-negative units to maintain their flexibility for emergencies. Alternatively, some may keep the same inventory and return a higher number of units of all blood types to the blood center. Either way, the potential for wastage increases, which may require the collection of more O-negative donors proportionally. It becomes important to not only transfuse O-negative units appropriately, but also to keep inventory levels of O-negatives to what might reasonably be used, and not indulge in “stockpiling.”

According to the recent BEST OPTIMUS study,<sup>5</sup> the fraction of O-negative units transfused at participating centers ranges from 3% to 13.9%. O-negative blood use could have been reduced by 44.5% if O-positive units were transfused to all O-negative patients >50 years of age, 9.9% for patients >80 years of age or 8.7% for all critical care patients >50 years of age. Results of studies examining the incidence of D alloimmunization in Rh-negative hospitalized patients transfused with Rh-positive RBCs demonstrate a lower alloimmunization rate of 21% to 26% than had been historically reported.

Therefore, this appears to be a safe practice. In the OPTIMUS study, 43.6% of the O-negative units were transfused to non-O-negative recipients. According to the authors, this may have been done to avoid the outdating described above by keeping too high of an inventory of O-negative units.<sup>5</sup>

One way to approach the issue is to collaborate with the blood center to establish a realistic inventory. Together, the average use of blood products by type throughout the past 3-6 months can be calculated. The model can then factor in trauma usage and travel time from the blood center to the hospital. This approach was used by the Canadian Blood Services (CBS), among others.<sup>6</sup> In addition to establishing reasonable inventory levels, CBS provided education and ongoing benchmarking tools to reduce outdates of all RBC units from 2.82% to 1.02%.

The use of algorithms and models to drive improved inventory management has been shown to reduce wastage; but trained staff are the most important tool, according to a study conducted in the United Kingdom.<sup>7</sup> In this study, five of the seven top-performing hospitals in managing wastage mentioned education as essential. All staff were instructed in the ethical responsibility of being good stewards of the blood supply. One hospital reduced the size of the refrigerator to decrease “panic ordering” when the refrigerators appeared empty. A strict “first in, first out” (FIFO) policy was important; this discouraged stockpiling of units at the transfusion service. Because they often received units close to expiration, ordering too many units was associated with wastage. Splitting orders to the blood center into only what was needed at that time also reduced the incidence of multiple units with the same outdate. Lastly, the study’s researchers found that keeping all inventory visible was important. This means the number of units at all locations and for all purposes (neonatal units, trauma units, operating room [OR] units, etc.) needed to be reviewed daily and the individual units considered part of the whole inventory pool.

## **CROSSMATCHES**

Other best practices for managing waste include electronic crossmatching at time of transfusion, thus reducing number of units unavailable in crossmatches and unable to be used. Units crossmatched for surgery might be released the same day, after the patient’s surgery, freeing units. Some institutions use a Maximum Surgical Blood Ordering Schedule<sup>8</sup> (MSBOS) to assist in managing surgical inventory by preventing over-testing of patients (e.g., type and screens and crossmatches). A study performed at University of Pittsburgh Medical Center compared actual use with the institution’s MSBOS for four weeks. Forty-nine percent of patients had at least one RBC issued and 72% of those units sent to the OR were returned to the blood bank. In 71% of the cases, all RBCs were unused. The crossmatch to transfusion (C:T) ratio ranged from 2.55 for transplant surgeries to 7.77 for colon and rectal surgeries. The study’s researchers found that 19% of wasted units throughout the past year had occurred in surgery.

The blood utilization committee at Mt. Sinai Medical Center in Miami Beach, Fla. met with surgeons and recommended a type and screen instead of a crossmatch when the following criteria are met: elective isolated valve, minimally invasive surgery, no antibodies identified in the screening process, clopidogrel (Plavix) dose < 150 mg, hematocrit > 30% (or hemoglobin > 10 g/dL), aspartate aminotransferase < 50 U/L, and creatinine < 1.5 mg/dL. Redo coronary artery bypass graft) CABG cases were excluded.<sup>9</sup> These changes helped to reduce the C:T ratio from 2.36 to 1.56, saving \$12,244 in four months for the cardiac surgery department.

## REJECTED SAMPLES

Nobody likes to be rejected, and that includes blood tubes! To prevent wrong-blood-in-tube (WBIT) errors, the transfusion service has to be strict in its requirements for sample labeling. Mislabeled tubes have a WBIT rate of 1.71.<sup>10</sup> Correcting for repeat samples and “silent errors” (assumed near-misses), the rate is even higher at 1:1.28. The Canadian transfusion error surveillance system reported 42,363 sample collection errors and 14,666 sample handling errors between 2006 and 2015. Sites with error detection mechanisms, such as drawing a second sample, had a lower error rate than systems that did not (12.1 per 1000 samples versus 17.3 per 1000). Each of these rejected samples represents unnecessary blood loss for a patient, lost time and added waste.

Poor pre-analytic variables extend beyond mislabeling. Hemolysis accounts for 40-70% of unacceptable samples submitted to the laboratory.<sup>11</sup> A cost model has been developed to demonstrate the significance of these issues. The cost of pre-analytic errors represents between 0.23% and 1.2% of total hospital operating costs, with 10% the actual costs of recollection and 90% the cost of delayed care. This is an opportunity to both save money and also to prevent blood loss associated with samples. During an admission to the intensive care unit (ICU), patients can lose 41 mL of blood each day for diagnostic tests, with a median blood loss of 200 mL over the course of their admission.<sup>12</sup> In some patients, this could make the difference in whether or not a blood transfusion is given. As many as 90% of patients develop hospital-acquired anemia by their third day in the ICU.<sup>13</sup> Good stewardship means reducing this amount of blood loss as much as possible for the patient and the hospital's benefit.

## CONCLUSION

PBM is defined as “getting the right blood to the right patient at the right time.” Stewardship follows this and stresses treating patients in the most effective manner. Ensuring O-negative units are given to O-negative patients with the potential of pregnancy, right-sizing inventory, reducing crossmatches and avoiding sample errors, all preserve the blood supply and ensure the highest level of quality and safety for patients.

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