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Incidence and Impact of a Single-Unit Red Blood Cell Transfusion: Analysis of The Society of Thoracic Surgeons Database 2010-2019

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ABSTRACT

BACKGROUND As the adverse effects of blood transfusions are better understood, recommendations support single-unit red blood cell (RBC) transfusions (SRBCT). However, an isolated SRBCT across the entire index admission suggests even the single unit may be avoidable. We sought to identify the characteristics of cardiac surgery patients receiving an isolated SRBCT and analyze the impact on outcomes.

METHODS The Society of Thoracic Surgeons Adult Cardiac Surgery Database was queried for the period between January 1, 2010, and December 31, 2019. Patients aged >18 years undergoing isolated coronary artery bypass grafting or isolated aortic valve replacement were included. A total of 2,151,430 encounters were analyzed.

RESULTS Of the 847,442 patients (39.3%) receiving any RBC transfusion during their index admission, 206,555 (24.4%) received only 1 unit. Propensity-matching analysis determined SRBCT patients were significantly older (67.26 vs 64.02 years; odds ratio [OR], 1.02; $P < .001$), female (39.1% vs 17.8%; OR, 1.57; $P < .001$), non-White (18.2% vs 13.1%; OR, 0.81; $P < .001$), and had a smaller body surface area (1.94 vs 2.07 m^2; OR, 0.20; $P < .001$). They also had higher mortality (1.4% vs 1.0%, $P < .001$), stroke (1.7% vs 1.2%, $P < .001$), prolonged ventilation (6.4% vs 3.4%, $P < .001$), renal failure (1.8% vs 0.9%, $P < .001$), and reoperations (1.3% vs. 0.5%, $P < .001$) than patients who received 0 RBCs.

CONCLUSIONS SRBCT is a common occurrence in adult cardiac surgery. This low-volume transfusion is strongly associated with higher morbidity, even after controlling for preoperative risk factors.

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More than 20 years ago, the Transfusion Requirements in Critical Care (TRICC) trial brought awareness to the negative consequences of blood transfusion in critically ill patients. This landmark study demonstrated that the mortality rate during hospitalization was significantly lower in the restrictive transfusion group vs the liberal transfusion group (22.2% vs 28.1%, $P = .05$).[1] A growing body of literature suggests that transfusion of red blood cells (RBCs) or other blood component therapy is associated with increased operative mortality (OM), venous thromboembolism, and infection proportional to the dose of the blood component given.[2-4] Moreover, RBC transfusions are also associated with long-term increased mortality and coronary artery graft failure.[5,6] A retrospective, observational cohort study of coronary artery bypass grafting (CABG) patients receiving even a

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small volume of RBCs (1-2 units) demonstrated significantly higher morbidity and mortality in the group that received the transfusion.[4]

Before the 1990s, clinicians were taught that if a patient needed an RBC transfusion, 2 units was the optimal dose for adult patients.[7,8] In fact, single-unit transfusions were strongly discouraged. One effective approach to Patient Blood Management in hospitalized patients has been to encourage single-unit RBC transfusions (SRBCTs) rather than transfusing 2 units at once. The "why give 2 when one will do" campaign has been used across the world to decrease unnecessary transfusions. During the past 30 years, as the adverse effects of transfusions have been more thoroughly understood, guidelines and recommendations have shifted to recommend single-unit transfusions.[8-10] However, when an SRBCT occurs across an entire admission for cardiac surgery, the need for any transfusion may be questioned.

We hypothesize that an isolated SRBCT during the index admission for cardiac surgery may be an unnecessary intervention. We examined a contemporary, nationwide cardiac surgery population who received an SRBCT to elucidate the association of an SRBCT on perioperative outcomes. Furthermore, we sought to identify predictors of SRBCT to help guide future perioperative management of cardiac surgery patients and potentially decrease the current transfusion rates of 40% to 50%, as indicated in The Society of Thoracic Surgeons (STS) Adult Cardiac Surgery Database (ACSD).

PATIENTS AND METHODS

PATIENT POPULATION. The data for this research were provided by the STS ACSD Participant User File Research Program. Data analysis was performed at the investigators' institution. The study was reviewed by the Weill Cornell Institutional Review Board and deemed to be exempt.

This retrospective cohort study included all patients in the STS ACSD who were aged ≥18 years and underwent isolated coronary artery bypass grafting (CABG) or aortic valve replacement (AVR) between January 1, 2010, and December 31, 2019. Data after 2019 were not included in the analysis given the potential confounding influence of the coronavirus disease 2019 pandemic. The STS database is the most robust clinical outcomes registry of adult cardiac surgery patients. Perioperative and outcomes data are collected prospectively by participating centers, which represent >95% of all cardiac surgery centers in the United States (https://www.sts.org/registries/sts-national-database/adult-cardiac-surgery-database).[11]

A total of 2,151,430 patient encounters were analyzed. Information on RBC transfusions were not available in 28,225 (1.3%), and these were excluded from the analysis. The present analysis included only patients receiving 0 or 1 RBC unit, regardless of transfusion of other components, and patients were stratified by the number of RBC units they received (0 vs 1). The indication or exact timing of a transfusion is not available in the STS database.

STATISTICS. Univariate logistic regression was performed with SRBCT as the dependent variable. In addition, propensity-score (PS) matching was used to estimate the effect of 1 RBC unit vs no RBC transfusion. The PS was built using logistic regression with a set of pretreatment variables, including baseline hematocrit. Only variables that had both a minimum incidence of 1% and missing data in <10% of patients were included in the PS model. Matching was performed using a caliper of 0.2 SD of the logit of the PS. Year of operation and site were also included in the PS model. Missing data were imputed with the median and mode value for continuous and categorical variables, respectively.

The STS ACSD does not include information regarding the indication for transfusion of blood and component therapies. The number of plasma and platelet units transfused in each group were not included as variables in the PS model but were reported in the unmatched and PS-matched group. The complete list of variables used in the PS model is found in Supplemental Table 1.

Outcomes of interest were 30-day or OM, postoperative stroke, sternal wound infection (SWI), prolonged ventilation (>24 hours of mechanical ventilation), and renal failure. The definition of renal failure is the presence of either or both of the following conditions: (1) an increase in serum creatinine level 3.0-times greater than baseline, or serum creatinine level ≥4 mg/dL (acute rise must be at least 0.5 mg/dL), and/or (2) a new requirement for dialysis postoperatively. Outcomes were reported in the overall matched sample and stratified by sex and type of operation. A McNemar test was used to compare the incidence of outcomes in the 2 treatment groups. The interaction between transfusion and baseline hematocrit level on mortality was tested using an interaction term in a fully adjusted model.

RESULTS

Of the >2 million patients undergoing isolated CABG or AVR included in the study, 1,303,988 patients (60.6%) did not receive any RBCs. Of the 847,442 patients with an RBC transfusion at any point during the index admission, 24.4% (206,555) received only an SRBCT. The administration of an SRBCT was significantly more common in the postoperative period than intraoperatively (66.8% vs 33.2%, $P < .001$). The characteristics of the patients in the 0-RBC group and SRBCT group are summarized in Table 1.

Logistic regression revealed that comorbid conditions were all more prevalent in the SRBCT group, including

TABLE 1 Population Characteristics

Variable	No RBCs (n = 1,303,988)	1 Unit of RBCs (n = 206,555)
Demographics		
Age, mean (SD), y	64.02 (10.28)	67.26 (10.39)
Female sex	232,270 (17.8)	80,680 (39.1)
Indexed body surface area, mean (SD), m^2	2.07 (0.23)	1.94 (0.24)
White = 1 (%)	1,133,268 (86.9)	168,958 (81.8)
Comorbidities		
Diabetes mellitus	554,871 (42.6)	99,539 (48.2)
Hypertension	1,124,903 (86.3)	182,811 (88.5)
Preoperative dialysis	11,912 (0.9)	6802 (3.3)
Preoperative creatinine, mean (SD), mg/dL	1.04 (0.63)	1.21 (1.12)
Chronic obstructive pulmonary disease	294,081 (22.6)	53,151 (25.7)
Peripheral vascular disease	138,220 (10.6)	30,940 (15.0)
LVEF, mean (SD)	0.5352 (0.1158)	0.5279 (0.1254)
History of stroke	76,385 (5.9)	17,581 (8.5)
History of cardiovascular intervention	369,621 (28.3)	59,821 (29.0)
Paroxysmal atrial fibrillation	107,559 (8.2)	18,496 (9.0)
Preoperative characteristics		
Preoperative hematocrit, mean (SD), %	41.05 (4.46)	37.58 (4.81)
Antiplatelet agent in previous 5 days	96,753 (7.4)	20,866 (10.1)
Anticoagulants within 48 hours	839,635 (64.4)	12,7687 (61.8)
Operation		
Urgent	675,205 (51.8)	11,5637 (56.0)
Aortic valve replacement	182,974 (14.0)	30,283 (14.7)
Coronary artery bypass grafting	1,212,014 (86.0)	176,272 (85.3)
Plasma transfusion (units)		
0	1,254,017 (96.2)	181,855 (88.0)
1	9541 (0.7)	5002 (2.4)
2	32,809 (2.5)	15,246 (7.4)
3	2111 (0.2)	1269 (0.6)
4	4643 (0.4)	2601 (1.3)
5	867 (0.1)	582 (0.3)
Platelet transfusion (unit)		
0	1,199,244 (92.0)	164,060 (79.4)
1	58,667 (4.5)	23,133 (11.2)
2	37,000 (2.8)	14,676 (7.1)
3	3010 (0.2)	1791 (0.9)
4	2462 (0.2)	1158 (0.6)
5	3605 (0.3)	1737 (0.8)
Timing of RBC transfusion		
No transfusion	1,303,988 (100.0)	0 (0.0)
Intraoperative	0 (0.0)	68,618 (33.2)
Postoperative	0 (0.0)	137,937 (66.8)

Data are presented as n (%) or as indicated otherwise. LVEF, left ventricular ejection fraction; RBC, red blood cell.

diabetes, hypertension, preoperative dialysis, chronic obstructive pulmonary disease, preoperative peripheral vascular disease, history of stroke or cardiovascular intervention, and preoperative atrial fibrillation (Table 2). The SRBCT group was also more likely to be older, female, non-White, and have a smaller body surface area. When controlling for baseline hematocrit, the risk of transfusions was not influenced by recent antiplatelet medication use or prior cardiovascular intervention (Table 3).

In addition to RBC transfusions, patients in each of the 2 study groups received other blood component therapy (plasma or platelets). In the no-RBC group, 120,824 (8%) received ≥1 units of platelets and 55,881 (3.7%) received ≥1 units of plasma. In the SRBCT group, 42,550 (20.6%) received ≥1 units of platelets and 24,787 (12%) received ≥1 units of plasma.

Propensity matching was performed and included all of the characteristics in Table 2, except for the surgical year. Matching produced 206,555 pairs between the 0-

TABLE 2 Risk Factors for Isolated Single Red Blood Cell Transfusion

Variable	Odds Ratio	95% CI	*P* Value
Age	1.02	1.02-1.02	<.001
Female sex	1.74	1.72-1.76	<.001
Indexed body surface area	0.20	0.19-0.20	<.001
Diabetes mellitus	1.13	1.12-1.15	<.001
White	0.82	0.81-0.83	<.001
Hypertension	1.05	1.04-1.07	<.001
Preoperative creatinine	1.17	1.16-1.18	<.001
Preoperative dialysis	0.87	0.83-0.91	<.001
COPD	1.08	1.06-1.09	<.001
Peripheral vascular disease	1.16	1.14-1.17	<.001
Left ventricular ejection fraction	0.99	0.99-0.99	<.001
History of stroke	1.15	1.12-1.17	<.001
History of cardiovascular intervention	1.01	1.00-1.02	.09
Paroxysmal atrial fibrillation	1.03	1.01-1.05	<.001
Urgent operation	0.99	0.98-1.01	.36
Antiplatelet agent within 5 days	1.22	1.19-1.24	<.001
Anticoagulants within 48 hours	1.07	1.06-1.09	<.001
Preoperative hematocrit	0.88	0.88-0.88	<.001
AVR (vs CABG)	0.90	0.88-0.91	<.001
Plasma transfusion	1.52	1.51-1.54	<.001
Platelet transfusion	1.54	1.52-1.55	<.001
Year of operation	0.95	0.95-0.96	<.001

AVR, aortic valve replacement; CABG, coronary artery bypass grafting; COPD, chronic obstructive pulmonary disease.

TABLE 3 Full Model on Mortality Controlling for Baseline Hematocrit and Transfusion

Variable	Odds Ratio	95% CI	*P* Value
Age	1.04	1.04-1.04	<.001
Female sex	1.56	1.49-1.64	<.001
Indexed body surface area	1.77	1.62-1.94	<.001
Diabetes mellitus	1.20	1.16-1.25	<.001
White	0.94	0.89-0.99	.025
Hypertension	1.14	1.07-1.22	<.001
Preoperative creatinine	1.15	1.13-1.17	<.001
Preoperative dialysis	1.41	1.22-1.62	<.001
COPD	1.57	1.51-1.64	<.001
Peripheral vascular disease	1.38	1.31-1.45	<.001
Left ventricular ejection fraction	0.97	0.97-0.97	<.001
History of stroke	1.36	1.28-1.45	<.001
History of cardiovascular intervention	1.02	0.98-1.06	.43
Paroxysmal atrial fibrillation	1.30	1.23-1.37	<.001
Urgent operation	1.33	1.27-1.39	<.001
Antiplatelet agent within 5 days	0.98	0.92-1.05	.65
Anticoagulants within 48 hours	0.89	0.85-0.93	<.001
AVR (vs CABG)	1.29	1.22-1.37	<.001
Plasma transfusion	1.25	1.22-1.29	<.001
Platelet transfusion	1.06	1.03-1.09	<.001
Year of operation	1.03	1.03-1.04	<.001
Preoperative hematocrit			
No red blood cells	0.98	0.97-0.98	<.001
1 unit of red blood cells	1.02	1.02-1.03	<.001

AVR, aortic valve replacement; CABG, coronary artery bypass grafting; COPD, chronic obstructive pulmonary disease.

RBC group and the SRBCT group (Supplemental Table 1). All adverse outcomes, including OM, stroke, deep SWI (DWSI), prolonged ventilation, and renal failure, were significantly higher in the SRBCT group compared with the 0-RBC (matched) group (Table 4). Propensity-matched analyses were also performed on the CABG-only and AVR-only groups (Supplemental Tables 2, 3). Again, OM, stroke, DSWI, prolonged ventilation, renal failure, and postoperative hemorrhage were significantly higher in the SBRCT cohort. Of note, there was no difference in DSWI in those undergoing isolated AVR (Supplemental Table 3). Outcomes were also compared after excluding patients who received platelets, plasma, or cryoprecipitate. The association between worse outcome and transfusion remained significant (Supplemental Table 4).

COMMENT

Anemia and blood transfusion have been implicated as negative influences on outcomes after cardiac operations.[12-14] Blood transfusions are influenced by factors that include preoperative red cell mass, signs and symptoms of anemia, blood loss, and absolute transfusion triggers. Our exploration was designed to help improve the understanding of the frequency of "low-dose" RBC transfusion and association with outcomes.

In our study, we found that patients who received 1 unit of RBCs during their index admission for cardiac operation were more likely to be older, female, non-White, and with a smaller body surface area. Additionally, the group that received a transfusion was more likely to carry preoperative comorbid diagnoses. In propensity-matched comparisons, patients receiving just 1 unit of RBCs throughout their index admission were more likely to experience a higher rate of mortality and stroke, prolonged ventilation, and renal failure than patients who received 0 RBCs during their admission.

A previous study of patients in the Michigan Society of Thoracic and Cardiovascular Surgeons Quality Collaborative (MSTCVS-QC) examined the impact of a 1- or 2-unit RBC transfusion on patients undergoing isolated, on-pump CABG from January 2008 to December 2011.[4] In that analysis of >20,000 CABG patients, they found that 48% had no RBC transfusion and 10% received a SRBCT. This is a higher overall transfusion rate than we found in our study (60.6% no RBCs), but we encountered a similar incidence of SRBCT (9.6%). It is also notable that 16% of patients in that study received 2 units of RBCs, and half of all patients who received a transfusion were given 1 or 2 units. The group receiving 1 to 2 units was compared with the

TABLE 4 Outcomes of Propensity-Matched Cohort

Variable	No RBCs (n = 206,555)	1 Unit of RBCs (n = 206,555)	*P* Value
Operative mortality	2058 (1.0)	2990 (1.4)	<.001
Stroke	2492 (1.2)	3458 (1.7)	<.001
Sternal wound infection	1070 (0.5)	1343 (0.7)	<.001
Prolonged ventilation	6990 (3.4)	13,305 (6.4)	<.001
New hemodialysis	1816 (0.9)	3703 (1.8)	<.001
Reoperation for bleeding	1064 (0.5)	2685 (1.3)	<.001

Data are presented as n (%). RBC, red blood cells.

0-RBC group and was found to be older, more commonly female, have a lower body mass index/body surface area, and more likely Black. The group had a higher incidence of diabetes, higher preoperative creatinine, and more perioperative renal failure on dialysis. They also demonstrated a higher incidence of hypertension, chronic lung disease, peripheral arterial disease, cerebrovascular disease, prior myocardial infarction, and heart failure in the group that received a transfusion. The group also had a higher incidence of adenosine-5′-diphosphate inhibitor use in the 5 days before the operation. Interestingly, the group that received a transfusion also had a higher prevalence of cigarette smokers and chronic lung disease, which would be expected to correlate with a higher preoperative red cell mass. The propensity-matched comparison demonstrated an association between SRBCT and a higher rate of OM, permanent stroke, postoperative renal failure, postoperative atrial fibrillation, prolonged ventilation, reoperation for bleeding, longer intensive care unit and hospital lengths of stay, and a nonhome discharge.

A more recent study from the Maryland Cardiac Surgery Quality Initiative (MCSCQI) examined the impact of any type of transfusion on patients undergoing CABG, isolated valve, or valve plus CABG during the period of July 2011 to December 2018.[3] More than 24,000 patients were included from 10 centers across Maryland. In this cohort, some type of blood product was transfused in 51% of patients, 85% of which included RBCs. Of those patients who received an RBC transfusion, 22% only received 1 unit; therefore, 57% of the entire cohort had no RBC transfusion and 9.5% received an SRBCT.

Our study considered the incidence and impact of SRBCT using a substantially larger cohort from a validated, national database. The rate of SRBCT was very similar in the MSTCVS-QC and MSCQUI studies and in our present data.[3,4] We did not examine the independent risk of multiple RBC transfusions or non-RBC blood component treatments, but the MSCQUI study demonstrated an incremental risk related to each unit of RBC transfusion and a higher risk related to RBC transfusion compared with non-RBC blood component therapies.

More patients in the more recent analyses (MCSQI and our STS analysis) received no RBC transfusion during the index admission compared with the Michigan study.[4] We attribute this difference to the progressive acceptance of restrictive transfusion practices, even in cardiac patients. During the past 2 decades, studies have shown a reduction in blood transfusion as Patient Blood Management programs have become common in most large hospitals.[11] In our study, the percentage of patients in the 0-RBC transfusion group clearly increased year over year. However, the incidence of SRBCT is strikingly consistent across all 3 studies. Our study confirmed the previous findings that RBC transfusions were more likely than 0 RBC transfusions in patients who were older, smaller, female, non-White, and had more comorbid conditions.

Only one-third of patients in the SRBCT group received a transfusion intraoperatively. Transfusion decisions in the operating room are often made based on estimations of blood loss or on point-of-care testing results, because central laboratories usually cannot keep up with the rapid turnaround time requirements of the operating room. Most point-of-care testing is not accurate enough to be used as an isolated trigger for transfusion decisions and is used as a trend indicator. Therefore, intraoperative transfusion decisions are more likely to be based on weaker data or physician perception of bleeding or physiologic impairment caused by anemia. Postoperatively, a central laboratory analysis of hemoglobin level would be more likely. This suggests that future work needs to be done to better understand the transfusion triggers used postoperatively, including hemoglobin threshold, physiologic symptoms, or lactate levels. The main weakness of this study is that the indication for transfusion cannot be known because this is a retrospective database study.

The cost associated with RBC transfusion is not insignificant. RBC transfusions were shown to be independently associated with significantly higher hospital costs by Trentino and associates.[15] In 2010, Shander and associates[16] calculated the mean combined direct and indirect cost per RBC unit to be \$761 ± \$294. Translated into the 2022 economy, each unit could be estimated to cost \$961. Using the most recent 2019 year as a conservative estimate of annual SRBCT, the cost of these transfusions may be >\$15 million per annum in the United States.

It is striking that even an SRBCT resulted in a strong statistically significant difference in mortality and morbidity. Randomized studies failed to show a significant difference between conservative and liberal transfusion strategies.[1,17-19] Unfortunately, those studies were limited by small sample size and highly selected populations. Ming and associates[13] showed that patients undergoing valve operation or CABG had a dose-dependent increase in postoperative complications and death when they received transfusion of RBCs, plasma, or >2 units of platelets.[13] Because of the observational nature of this study, we cannot rule out that patients who received a transfusion were the sickest and therefore their outcomes were worse, even with the propensity matching. It is possible that patients with more risk factors for complications after cardiac operations were perceived by their treating physicians as more symptomatic or in need of a higher hemoglobin level. Although it is attractive to suggest that reducing blood products will result in a reduction in mortality and morbidity, it remains unknown whether it is the transfusion, preoperative anemia, or the circumstances that imply a need for transfusion and account for the worse outcomes.

Our study has some important limitations, but also significant strengths. The strengths of our study include a very large, contemporary patient population across the entire United States. Additionally, the source of our data is a highly respected, validated database that is prospectively collected. This provides a far superior source of data compared with most database analyses that contain administrative data.

Even though the data included are from multiple centers across the nation, our analysis is retrospective and largely observational. We have no insight into the preoperative and in-hospital anemia management (other than transfusion) for patients in the database. Given that the overall prevalence of preoperative anemia in patients undergoing cardiac surgical procedures is thought to range between 22% and 30%,[20] patients who received a single RBC unit could possibly have been optimized for underlying anemia before or after surgical procedures. As a result, a transfusion would never have been considered. This has been demonstrated in populations in which blood transfusion is not an option, such as Jehovah's Witness patients.[21]

Although all the analyses to assess the outcomes were adjusted for patient characteristics, it is possible that not all confounding variables were included. Other factors not included in the STS database may have influenced transfusions, including preadmission transfusion, timing of catheterization, and subjective bleeding concerns by the surgeon.

Finally, this analysis did not consider what transfusion thresholds or practice guidelines were in place at individual institutions and how that may have influenced our observations, because these data are not available in STS database.

The most outstanding finding in our study was that of the patients who received an RBC transfusion, 1 in 4 would only receive a single RBC unit for the duration of the admission. Knowing that is a frequent occurrence may encourage clinicians to raise their transfusion trigger threshold and/or improve preoperative optimization of red cell mass. The pattern of overall reduction in RBC transfusions year to year, with a stable rate of SRBCTs, indicates that monitoring SRBCT alone is not an adequate barometer of Patient Blood Management interventions. It many show that patients previously receiving 2 units only received 1, and those previously receiving 3 units only got 2, and so on.

It is also important to understand whether single-unit transfusions are necessary to improve patient outcomes or simply reflect a clinical bias about whether the patient can tolerate a lower hemoglobin level. A future study of transfusion indication as well as pretransfusion hemoglobin would be an important start to address this question. Another important area of future study is whether RBC transfusion relieves the symptom of anemia being treated. RBC products are a scare resource with significant potential risk that should be conserved for strong indications, which are yet unresolved.

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DISCLOSURES

Dr Cushing has a consulting or advisory relationship with Octapharma and relationships with Haemonetics Corporation and Cerus Corporation that include board membership. The other authors have no conflicts of interest to disclose.

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Blood Transfusion as a Never Event: It Is Possible?

INVITED COMMENTARY:

In this issue of *The Annals of Thoracic Surgery*, Ivascu Girardi and colleagues[1] put forth an excellent hypothesis: single-unit red blood cell (RBC) transfusion during an index admission for cardiac surgery may be an unnecessary intervention, in other words, a never event. To test this hypothesis, The Society of Thoracic Surgeons database was used and queried for cardiac surgery patients between 2010 and 2019. In addition, Ivascu Girardi and colleagues[1] used this study to identify predictors of single-unit RBC transfusion in cardiac surgery; of the 2 million patients included, approximately 60% did not receive any RBCs. It is therefore not unreasonable to think that if only a single unit is given across an entire patient stay and in a predictable group of patients, a single-unit transfusion could become a never event. It has been long identified that any transfusion is associated with worse outcomes, both short and long term.[2,3] We have many trials, evidence-based guidelines, and publications that have continued to show that less is more, or at least is not as dangerous.[4] So what will it take to use more than 2 decades of evidence to render transfusions among cardiac surgery patients never events?

Benchmarking of transfusion rates against peers is essential. When an increased rate of transfusion among peers is detected, critical root cause analysis should be performed.[5] The delivery of every unit of RBCs or other blood products should be included in morbidity and mortality rounds. The use of a critical root cause analysis framework will serve to illuminate differences in preoperative anemia management, transfusion triggers, and provider variation in transfusion practices.[5] There is an identified opportunity, noted in the paper by Ivascu Girardi and colleagues,[1] for The Society of Thoracic Surgeons Adult Cardiac Surgery Database to collect data accurately relative to indications for blood or component therapies. If these data were available, a more thoughtful root cause analysis could be performed. If we capture the "why" that leads to transfusion, it will be possible to render transparency in care deviation, preoperative anemia management improvements, and the need for reeducation. Blood transfusion can be rendered a never event; we must continuously ask the question and be accountable for the "why."

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