



Margin of Excellence

Blood Utilization

“Margin of Excellence” is a series of reports dedicated to uncovering next generation total cost management savings and quality improvement opportunities through integrated data and services. The reports provide detailed insights on costs looking at a single setting, or multiple settings, and across the continuum. The data and benchmarks can be leveraged to implement evidence-based strategies and tools designed to tackle inefficiencies in healthcare, ranging from variation in clinical practice and resource utilization – fulfilling the dual mission of improving care and reducing costs.

The analyses tap Premier’s robust database, which offers a holistic view – linking clinical, financial and supply chain data.

WHY PATIENTS NEED BLOOD TRANSFUSIONS:

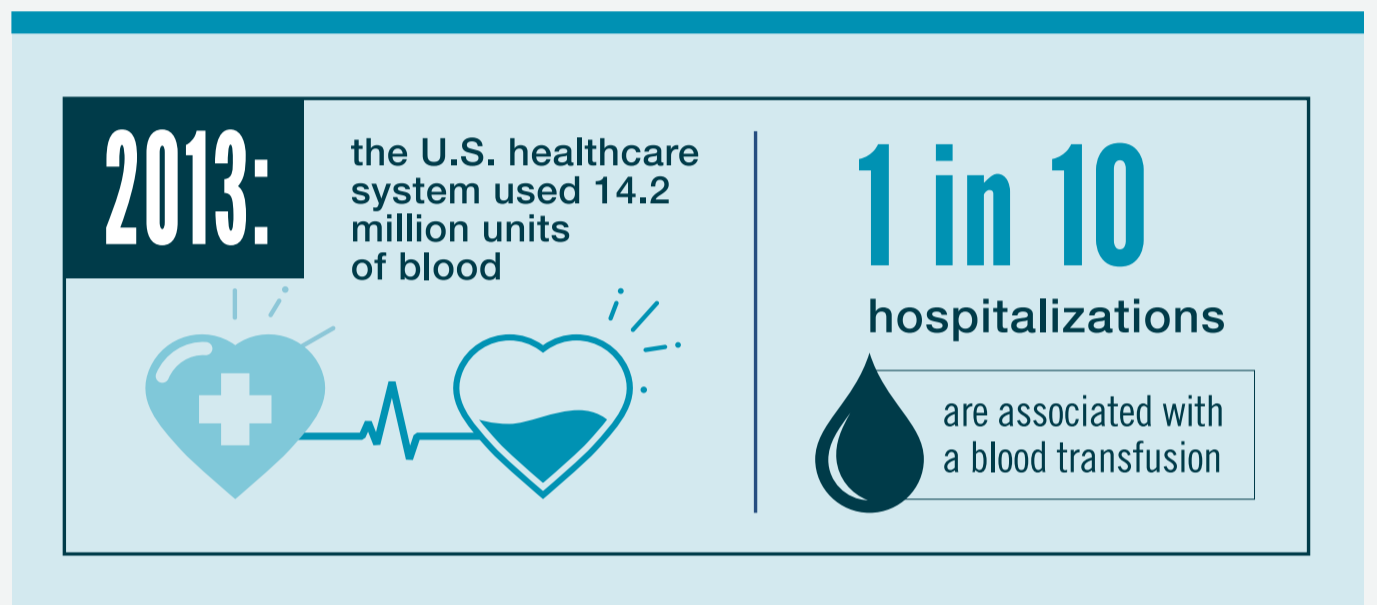
Anemia - The condition arises from blood loss and can be a complication stemming from other illnesses, including kidney disease or cancer, as well as medicines or radiation. However, anemia may not require a blood transfusion at all.

Surgery - Blood transfusions may be required during surgery as a result of blood loss. To put it in context, about one-third of all heart surgery patients require a transfusion and practices about when and why to use a blood transfusion can vary widely between surgeries. Although blood may be lost during surgery, blood transfusions are not always necessary.

Blood Disorders - Abnormal bleeding and clotting can result from inherited blood disorders, which can be controlled if symptoms are caught early and treated, but may require blood transfusions in more severe circumstances.

Introduction

Often, a blood transfusion can mean the difference between life and death. Blood and blood products are crucial, life-saving commodities used in a wide range of medical procedures, including cardiac and orthopedic surgeries, trauma care and chronic medical conditions. In 2013 alone, approximately 14.2 million units of blood were used¹ across the U.S. healthcare system, and most of these transfusions occurred within a hospital setting. In fact, one in 10 hospitalizations are associated with a blood transfusion.²



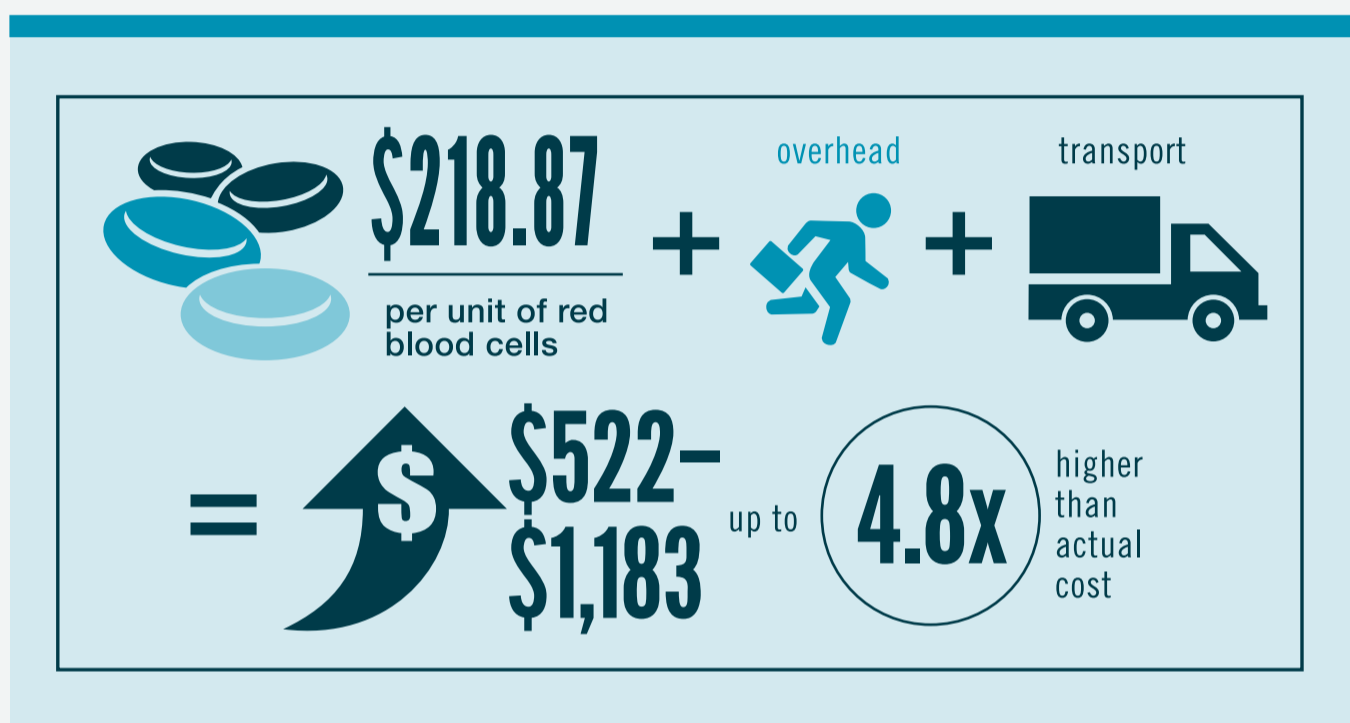
Providers must aim to strike the right balance between having enough blood on hand to meet patient needs, while trying to avoid excess supply. Effective stewardship of limited blood supplies is crucial to avoid regional or even national blood shortages, which can occur in the event of a natural disaster or a disease outbreak.

Additionally, unnecessary blood use can negatively impact patient care. According to the 2011 National Blood Collection Survey and Report, an estimated total of 51,000 transfusion-related adverse events occurred. These include allergic reactions, fever, lung injury, immune suppression, renal injury, iron overload and others.³

It's also in a health system's financial interest to effectively manage blood products. Blood products are expensive, and sensitive to significant price fluctuation based on availability. In 2013, hospital respondents to an American Association of Blood Banks (AABB) survey reported an average cost of \$218.87 per unit of red blood cells⁴. In

addition, providers also absorb indirect expenses like transport and overhead that can raise cost of blood to \$522-\$1,183 per unit—up to 4.8 times higher than the actual cost of the physical unit of blood.⁵

Blood transfusions are widely used on the frontlines of healthcare, as nearly five million Americans need blood annually. To put it in perspective, blood was associated with \$4.6 billion in Medicare charges out of \$442.5 billion in total Medicare charges across all MS-DRGs.⁶

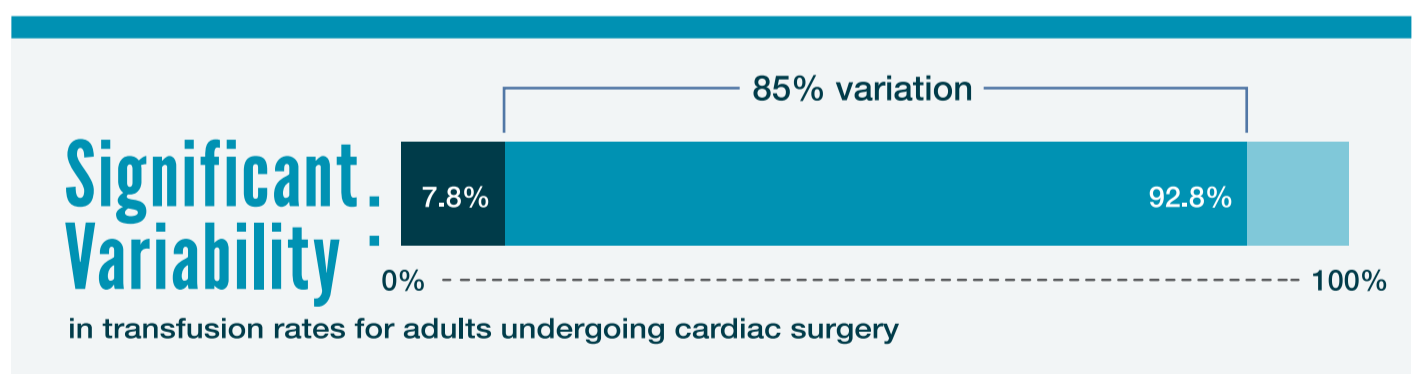


Variation in Blood Use: Quality and Financial Implications

Blood use protocols and practices vary significantly across hospitals and departments, and estimates suggest that approximately 40 percent of the blood and blood products used nationally may be unnecessary.⁷ In fact, any two patients receiving the same surgery may or may not receive a transfusion depending on a provider's culture around blood use—which can compromise quality of care.

Just looking at two surgical procedures highlights this clinical variation and the need for greater stewardship of blood and blood products.

- Cardiac surgeries: Cardiovascular surgery accounts for 20 percent of blood transfusions given in United States.⁸ However, significant variation remains: a recent JAMA article highlighted significant variability in blood use among patients undergoing adult cardiac surgery, as the rates of transfusion ranged from 7.8-92.8 percent.⁹ Blood transfusions have been associated with poorer outcomes among cardiac surgery patients and have been linked to increased risk for late mortality.¹⁰ In fact, studies have found that patients under age 80 who receive one or two extra units of blood face a 27 percent increased risk of heart failure, as well as a lower overall survival rate.¹¹ Additionally, researchers examined patients who received transfusions and compared them to those who were not transfused during a five-year period and found the mortality rate in the transfused group was more than double that of the non-transfused group (16 percent vs. 7 percent). When accounting for comorbidities and other factors, blood transfusions were associated with a 66 percent increased risk of mortality.¹² These findings highlight the need to use blood transfusions only when necessary during cardiac surgery.



- Orthopedic procedures: Extended inpatient stays related to postoperative care are a major expense when it comes to the overall cost of total hip replacements and other orthopedic procedures.¹³ Studies have found that transfusion of one or more units of blood triples a patient's risk for a longer inpatient stay of three or more days after joint surgery.¹⁴ When using improvement strategies, research has linked implementation of an effective blood management program to reduced length-of-stay by a day for total hip replacements and

two days for total knee replacements.¹⁵ Another study associated a significant drop in 30-day readmissions among patients undergoing total knee and hip surgery to decreased blood use.¹⁶

As cost pressures mount upon providers, blood conservation is a key area of focus where hospitals and health systems can improve the quality of care, reduce risk to patient safety and eliminate excess spending concurrently. In terms of costs, researchers examining blood utilization practices during abdominal surgery found significant variation. The liberal or unnecessary use of blood resulted in extra costs ranging from \$100,320-\$346,560 over a nearly four-year period in one health system.¹⁷

Researchers have found that it pays to invest in effective patient blood management programs: a community teaching hospital worked with frontline providers to comply with evidence-based transfusion criteria and reduced costs of all blood products across all patient populations by more than \$2.2 million in a two-year period,¹⁸ and another health system estimated savings associated with reduced blood utilization around \$18.1 million.¹⁹

Essentially, less is more when it comes to blood transfusions.

Success Story:

UNIVERSITY OF TENNESSEE MEDICAL CENTER – KNOXVILLE, TN

In 2012, leaders at the University of Tennessee Medical Center decided to embark upon efforts to decrease unnecessary transfusions. After evaluating their data, the group identified elective joint replacement surgery as the greatest opportunity area. Working quickly to pilot a program, the Joint Replacement Performance Improvement Committee introduced two strategies to reduce blood use. One was stricter protocols for transfusions. At the time, patients who had a hemoglobin ≤ 10 g/dL were automatically receiving two units of red blood cells with the initial transfusion order. The stricter protocol required a symptomatic hemoglobin of ≤ 8 g/dL in order for a patient to be transfused, and for one unit to be transfused at a time.

The second strategy focused on the intraoperative use of tranexamic acid (TXA) to control blood loss during total hip and total knee replacement, which helped improve blood conservation. Based on initial success from a trial run, the practice became a standard operating procedure for all surgeons.

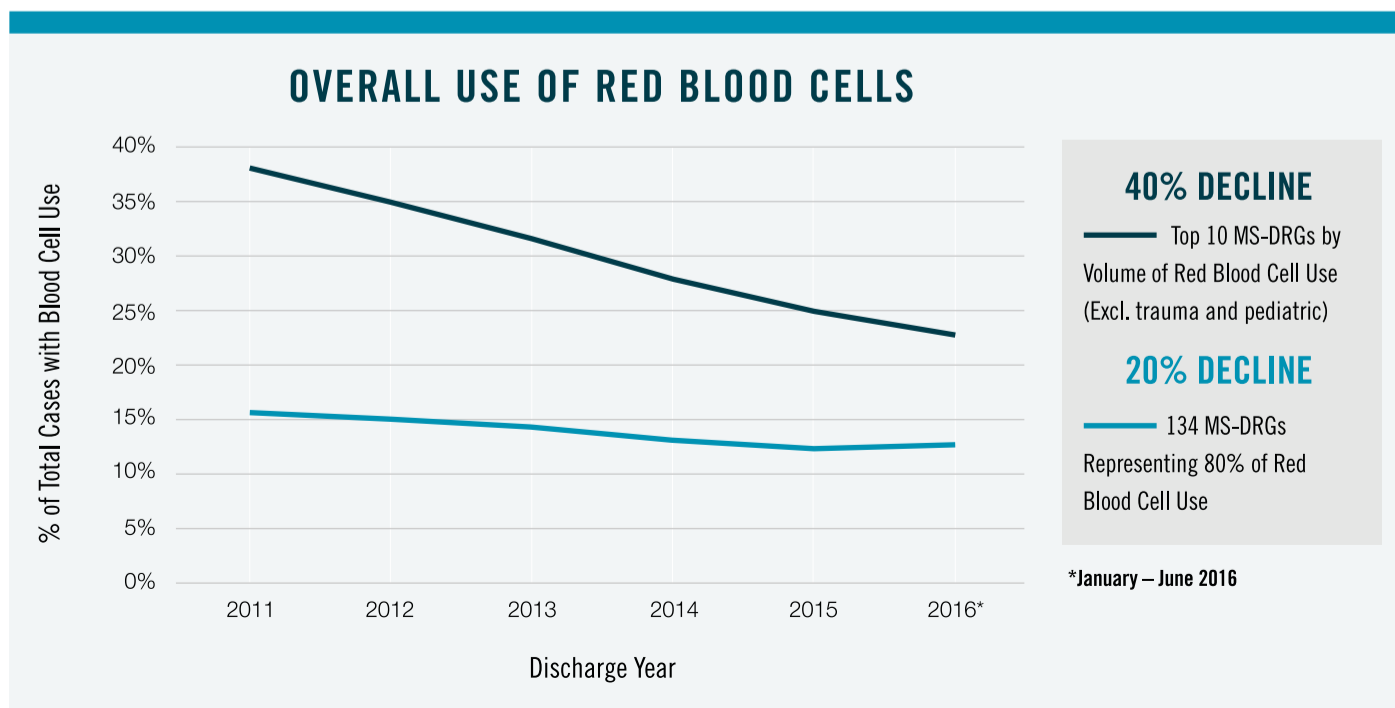
Incorporating this dual approach, the transfusion rate was reduced by 50 percent. Prior to the implementation of these evidence-based practices, the rate of transfusion for patients undergoing these procedures was 15 percent. As of March 2017, only 3.2 percent of patients have received a transfusion.

Additionally, the team projected a savings of \$158,000 annually in total transfusion costs after the practices were put in place.

Progress by Providers to Reduce Unnecessary Blood Use

While variation exists across hospitals in terms of blood utilization and the adoption of patient blood management programs, providers have made headway and honed in on improving blood use practices, according to a Premier analysis. These results can be leveraged by providers seeking to pinpoint areas of improvement by examining how their performance compares to Premier’s trend data on blood utilization.

FIGURE 1: SIGNIFICANT DECLINES IN BLOOD UTILIZATION



Researchers reviewed inpatient data from 645 facilities, representing more than 27 million discharges. Examining 134 diagnoses that account for 80 percent of red blood cell utilization, the research found that 20 percent fewer patients received blood over a 5.5-year period.

When isolating 10 procedures that use the most blood, the data highlights a staggering decline: 40 percent fewer patients received blood.

During this same period, when compared with quality data, trends suggest that reduced blood utilization didn't negatively impact patient outcomes – as rates of mortality, complications and readmissions also fell.

These significant decreases of unnecessary blood utilization are a direct result of provider-led efforts to optimize care who are improving use of this costly commodity and employing evidence-based practices.

As providers have recorded declines in blood use, there have also been documented shifts over time in the types of procedures that account for significant blood use and transfusion variation.

Most notably, orthopedic surgeries have seen a steady drop in transfusions recorded over more than a five-year period (Figure 2). When looking at major joint replacements, remarkable progress is seen, as nearly 75 percent fewer cases were associated with blood transfusions. Additionally, nearly 30 percent fewer patients undergoing hip and femur surgeries received a blood transfusion.

FIGURE 2: SHIFTS IN BLOOD UTILIZATION AMONG PROCEDURES

PROCEDURE	PATIENTS RECEIVING BLOOD 2011-2016
Major Joint Replacement without multiple chronic conditions	↓ 72.4%
Hip and Femur Procedures except Major Joint with chronic conditions	↓ 28.4%
Major Small and Large Bowel Procedures with multiple chronic conditions	↓ 23.8%
Red Blood Cell Disorders without multiple chronic conditions	↓ 15.3%
Red Blood Cell Disorders with multiple chronic conditions	↓ 7.0%

Success Story:

BAYCARE HEALTH SYSTEM – TAMPA, FL

In 2011, BayCare Health System, a health care system that connects patients in Tampa Bay and central Florida to a wide range of services at 14 hospitals and hundreds of other outpatient locations, participated in a strategic survey and found blood utilization to be a ripe area to optimize and standardize protocols. Ahead of the curve, the team approached blood utilization overall across all services lines.

With an emphasis on physician and nursing education, the BayCare blood management team got the word out around a concerted campaign which focused around the slogan, “Thanks for Being Part of the Transfusion Solution” and catchy phrases such as “Why Give Two When One Will Do?” The team emphasized educational programs and one-on-one conversations with the clinical teams guided by evidence-based information on the benefits of using blood more conservatively.

New protocols and practice guidelines were implemented across all BayCare hospitals. They also implemented alerts triggered by ordering practices that fell outside of the transfusion guidelines and worked to help steer physicians toward best practices. By 2013, the program had been standardized across the health system by implementing it one hospital at a time.

Working with Premier, BayCare gained access to critical performance benchmarks for peer comparisons and was able to compare blood usage across various service lines. The team also emphasized perioperative anemia management and worked with the orthopedic unit on the introduction of tranexamic acid use during surgeries to reduce blood loss.

The holistic effort saw a direct impact on the rate of transfusions, helping improve patient care. Since the program began, BayCare has seen a 54 percent decrease in red blood cell use, which amounts to more than 58,000 units saved. While the focus of

this effort has been devoted to improving quality of care, BayCare has also been able to significantly reduce spending on blood.

Leadership invested time and resources toward making blood utilization a priority. Because the BayCare team worked with a patient-centered approach, involving the nursing and medical teams, the improvement in blood usage was embraced by all, which was fundamental to the success of the program.

Benchmarking Progress

Using Premier data, providers have a compass, helping them improve blood use variation and measure progress against Premier member benchmarks. With constrained resources, hospitals and health systems are doing “less with more.” Using this intelligence to highlight how a hospital or health system’s performance compares to their peers, leaders have an opportunity to target clinical variation in blood use and reign in ineffective practices to improve care and reduce costs. Whether looking at blood utilization overall or pinpointing specific procedures that account for significant blood use, providers can drive real change across services lines and apply evidence-based practices when working with physicians, clinicians, surgeons, anesthesiologists and other frontline medical providers on shifting habits around effective blood use.

Success Story:

MERCY HEALTH – CININATTI, OH

In 2012, Mercy Health, a health system with 22 acute care facilities serving residents in Ohio and Kentucky, saw an opportunity to improve care and reduce costs by optimizing blood use. Overall, blood products and indirect expenses accounted for \$26 million in spending. Working with Premier, leaders at Mercy Health were able to conduct an in-depth analysis of the current state of blood utilization and create the infrastructure needed to ensure compliance around new blood use protocols.

Strategies to foster optimization of blood use included physician engagement; enlisting cross-functional clinical and operational teams for feedback and engagement of frontline providers; creation of committees in each hospital to carry out the work; ongoing conversations around feedback and monitoring of performance; engagement of quality team members to assess appropriateness of blood products administration; and education on blood conservation strategies.



Use of blood products could be monitored with the infrastructure in place, and data reports were pulled to inform conversations with clinical leaders.

Data was monitored for trends to see if physicians were ordering more than one unit of blood or transfusing outside of electronic health record protocols – allowing leaders to follow up with clinicians on best practices.

During a three-year period, Mercy realized \$6.2 million in savings as a result of conserving red blood cell, platelet, plasma and cryo use (70 percent of savings was result of reducing blood use). The savings reflects conservation efforts in both inpatient and outpatient facilities, without compromising quality.

Putting the patient blood management infrastructure in place was a key piece of the puzzle in optimizing transfusion practices within the market. This gave Mercy data and methodology they never had before to measure their utilization – which is a challenge many hospitals and health systems have when looking to implement effective patient blood management programs. With this new transparency, Mercy has been able to sustain and improve every year since the monitoring platform was implemented.

Best Practices in Patient Blood Management

As seen in the data, many providers have recognized the need to optimize blood utilization. While no two patient blood management programs are alike, hospitals and health systems are able to tailor programs to achieve the best results in curbing unnecessary blood use.

According to a 2013 survey of AABB member hospitals, only 36 percent of providers reported a formal patient blood management program. But incorporating select blood stewardship strategies is a popular approach, with more than 45 percent of hospitals reporting having implemented at least three strategies to better manage blood utilization.²⁰

Programs often include education aimed at guiding providers toward optimal decision-making, clinical decision support tools, benchmarking data and evidence-based guidelines to improve blood utilization practices.

Success Story:

GEISINGER HEALTH SYSTEM – DANVILLE, PA

Dr. Amanda Haynes, a pathologist at Geisinger Health System, used Premier data to navigate how the health system's blood utilization performance compared to their peers. The data offered evidence on how Geisinger had real opportunities to improve their blood use, created a sense of urgency and fostered a cultural shift. By highlighting how many more transfusions their physicians were ordering compared to other health systems, Dr. Haynes had solid evidence, which provided motivation to both C-suite and clinical staff to enhance blood stewardship. The resulting system-wide effort helped reduce blood use by 23 percent and 27 percent at Geisinger's two largest campuses, respectively, and resulted in more than one million dollars in savings in 2015.

The Business Case for Hospital Leadership

In the C-suite, leaders often look to the return on investment when putting up financial and staffing resources for initiatives. With so many competing initiatives, it's important to advocate for patient

blood management with key details and rationale on how these efforts improve patient safety, quality of care and total cost management.

Success Story:

CARLE FOUNDATION HOSPITAL – URBANA, IL

At Carle, leaders took notice of blood use rates and saw areas of opportunity to improve. Using PremierConnect® quality and lab ordering data, the team had a foundational understanding of internal blood ordering trends and could leverage it to compare their use against peers. To put it in perspective, leaders at Carle found their red cell blood use was significantly higher (10 percent of admissions) compared to Premier benchmarks

(5-6 percent of admissions) in 2013. Seeing this difference was a powerful motivator to drill deeper to identify the high utilizers and implement evidence-based practices with each department.

For instance, leaders highlighted how the geriatric and obstetrical management departments should treat anemia proactively with iron supplements, rather than waiting for the condition to worsen to the point where patients need transfusions. As a result, the use of IV iron has gone from 3-4 doses a week to 2-5 doses of day. Working with hospitalists, another program set hemoglobin standards for non-bleeding patients, and created standard order sets for cases of anticoagulation reversal.

Since the new practices have been shared with frontline providers and monitored, ordering practices have improved significantly, especially when feedback is provided and physicians can examine how they compare to their peers. Additionally, computerized alerts were triggered when a doctor orders blood and reminds them of guidelines in place for proper blood use. With consistent feedback and reminders, the culture shift has taken shape and old habits have been replaced with new evidence-based standards. The informal patient blood management program didn't require significant investment aside from staff time to build and sustain the program, and technology to support it.

With the improvements in place, blood utilization has steadily decreased. In 2013, 14,198 blood components were given to Carle ambulatory and hospital patients system wide. In 2016, blood component use dropped significantly, as only 9,100 components were administered – representing a decrease of more than 5,000 transfusions. In terms of cost savings, the hospital has saved nearly two million dollars over a two-year span (2015-2016) as a result of the shifts that took place in optimizing blood use, including the reduced cost of blood components and staff time involved in the transfusion process.

Moving the Needle with Clinical Staff

In order for patient blood management programs to thrive, buy-in from frontline providers is a critical piece of the success but can present major challenges. With respect to clinicians making important, life-saving decisions on what's best for a patient, evidence-based guidelines should be implemented to help steer physicians in the right direction around effective transfusion practices without threatening their autonomy.

The need to adequately address changes to the status quo are critical. Some research has pointed to misuse or overuse blood products despite guidance – one study found 15-30 percent of blood products are used outside of evidence-based guidelines.²¹

Because transfusion practice fluctuates between hospitals, departments and procedures, it's important to understand the dynamics that drive blood-ordering behavior, which lays the foundation for building a patient blood management program tailored to a hospital's unique needs.

To help usher in shifts in practice and behavior, the strategies outlined below can assist with culture change and creating new standards of care for blood use:

- **Collaboration:** The use of a multi-disciplinary transfusion committee is a critical component. This group can lead the collaborative effort across departments to make effective blood use a priority and encourage

widespread adoption. Representation from clinical leadership like the medical director, transfusion safety officer, physicians representing all major medical and surgical departments that regularly order blood, hematologists, pathologists, anesthesiologists, nurses, lab personnel and other stakeholders can provide unique perspectives when it comes to creating and implementing a blood management program. This group oversees monitoring around physician ordering practices, auditing and benchmarking current transfusion practices, and establishing hospital-wide best practices, as well as reviewing progress around how practice affects quality of care (i.e. adverse effects). This group can also observe compliance around newly-implemented guidelines and establish a feedback loop with physicians on quality improvement opportunities

- **Education:** Longstanding habits and lack of information around alternatives to blood transfusions can be tackled with targeted physician education efforts. Creating campaigns to underscore the minimal use of blood (i.e. “why give two when one will do”) are catchy, but incorporating feedback from physicians who order blood and establishing communication loops are also vital to success. Holding rounds with relevant departments, garnering feedback on guideline development and dissemination, and real-time feedback and practice reviews are all strategies that can be used. Clinical decision supports (highlighted in the tools section below) can educate physicians ordering blood via real-time alerts if an order doesn’t follow evidence-based guidelines.
- **Focus on Perioperative Management:** Patients who go into surgery with anemia are more likely to receive a transfusion, as well as to have increased infection rates, length-of-stay and higher risk of mortality.²² Yet, anemia is a treatable condition that can be addressed prior to surgery without a transfusion. Understanding risk factors for patients and addressing these underlying issues before they ever reach the operating room can reduce the need for transfusions. Care redesign efforts like bundled payments encourage preoperative risk assessments to ensure optimal recovery for patients. Applying this strategy to patients going into procedures associated with a high volume of blood use can help physicians identify risk factors that can be addressed prior to surgery and avoid the transfusions.

Taking into account a patient's history before surgery and creating individualized risk assessments based on age, current medications, comorbidities and family history of bleeding disorders, as well as measuring preoperative hemoglobin (Hb), estimating expected blood loss during the procedure and adhering to strict transfusion thresholds can all help reduce the need for unnecessary transfusions.

Success Story:

WHITE RIVER MEDICAL CENTER – BATESVILLE, AR

Working with Premier through the Perioperative Surgical Home Collaborative, a team including surgeons and anesthesiologists at White River Medical Center have implemented a series of protocols aimed at improving blood utilization during orthopedic surgeries. This included treating preoperative anemia, use of tranexamic acid and lowering of transfusion thresholds. Additionally, shifting practices slightly to shorten operation times and using aspirin over Lovenox to reduce blood loss were included in the program as well.

Since the program has been implemented, the transfusion rate has been reduced by more than 50 percent.

Success Story:

UNIVERSITY OF TENNESSEE MEDICAL CENTER – KNOXVILLE, TN

The University of Tennessee Medical Center (UTMC), a Level I trauma and academic medical center, had been experiencing critical inventory challenges, shortages of blood products and price fluctuation when sourcing with their local blood center. Patient volume growth and an influx of complex cases increased UTMC's need for blood products. Initially, UTMC responded to the situation by implementing a carefully constructed blood utilization program, which addressed proper blood product use and availability, but not cost.

Through collaboration with Premier and Bloodbuy, UTMC was able to implement a program that sourced blood beyond the region and delivered blood products in a timely manner at a reduced cost with ultimate value to the patient. To date, UTMC has reported up to 17 percent in savings for the products purchased through the Bloodbuy platform.

Critical Tools Necessary

In order to monitor utilization and adherence to guidelines and provide feedback to clinicians, investments in key resources are essential to making patient blood management programs work.

- **Data, Data, Data:** Use of data is crucial to assess and inventory current practices in blood utilization, as well as transfusion rates for certain procedures. Data can also provide comparative benchmarks that systems can use to evaluate their utilization and outcomes performance relative to peer systems. By leveraging data, providers can monitor the number of transfusions that fall outside evidence-based guidelines and physician compliance. Using databases like PremierConnect quality and enterprise analytics, providers can easily capture and track patient information and get actionable data, aggregating all MS-DRGs to evaluate transfusion use or number of units of blood ordered. The snapshot provides a simple, easy way to trend monthly or annually to examine excessive use of blood.
- **Clinician Decision Support Tools:** Computerized physician order entry (CPOE) or electronic ordering provides a useful channel to “hardwire” transfusion guidelines. These systems can provide alerts that are triggered by questionable ordering practices – helping redirect physicians to an alternative action with clinically relevant information. These tools provide education, review, feedback and rationale through use of references, reminders, alerts, recommendations and guidelines about transfusion practice. Research has shown these alerts have been effective in terms of overall reduction in blood component use: an academic medical center reported success in reducing blood transfusions at both adult and pediatric institutions through the use of clinical decision support tools triggered through CPOE.²³

- Next-Generation Solutions: Additionally, incorporating new, unique technology and solutions which are disrupting the blood market can help reduce margins even further. Bloodbuy, a healthcare information technology company that Premier has invested in and operates a cloud-based platform connecting hospitals and blood centers. The company has helped hospitals manage inventory appropriately and pinpoint overutilization through easy-to-use dashboards.
 - Benchmarks: For example, a provider may not realize they're overusing O-negative blood units – a universal donor type that is most expensive. The dashboards provide key benchmarks in terms of how these ordering patterns compare to other providers to highlight any outlying practices.
 - Innovative Sourcing: Additionally, Bloodbuy has disrupted the way providers acquire blood through the procurement process. Many regions are serviced by one major blood supplier, which results in little to no competition, price inflation and no sharing of real-time (or even recent) market information relating to per unit cost and availability for identical blood products. With access only to regional blood provider monopolies, hospitals and health systems are vulnerable to price manipulation and shortages. The company's technology enables hospitals and health systems to optimize their blood product procurement by accessing a broader market – essentially creating a "Priceline-like" buying structure where providers name the amount they're willing to pay for blood products. So a hospital in Missouri doesn't have to just buy from local or regional blood suppliers, but can go beyond and source blood products from the Northeast or West Coast – removing risk for shortage, reducing labor needed to manage product orders and generate cost savings.

Summary

As physicians and providers become more aware of the costs and adverse patient outcomes associated with blood transfusions, we can only expect sustained progress in reducing unnecessary blood use. Premier's trend data highlights a growing understanding among providers and physicians about the benefits of reduced blood use, which has generated real results and care improvements. While there remain opportunities for improvement, the staggering declines in blood use in a little over five years is a major step in encouraging all hospitals and health systems to enhance blood use and foster an effective hospital transfusion culture.

For more information on Premier's expertise and data which helps providers optimize blood utilization across institutions, contact our team to learn about resources and solutions we've developed to guide members through this opportunity to improve care and reduce costs.

Methodology

Premier's database acquires, aggregates, cleanses and manages clinical, financial and operational data on ~40% of U.S. health system discharges. Tapping this resource, our blood utilization analysis included data from 645 facilities, representing more than 27 million discharges from 2011-June 2016. Only inpatient cases were included and reviewed charges for blood transfusions from 134 Medicare MS-DRGs which account for more than 80 percent of blood utilization at these hospitals (excluding pediatric and trauma patients).

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