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Blood Utilization Program: Is there a Need to Implement? A Case Study at Sutter Medical Center, Sacramento

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Abstract

Blood utilization programs retroactively examine the appropriateness of blood transfusions, with the goal of finding areas for improvement which could ultimately lead to minimizing blood usage. While blood transfusions save lives they can also have a negative impact which would include but not be limited to, infectious and non-infectious risks for the patient, impacting the community's blood supply by decreasing the number of available units, and an increase in overall healthcare cost during a patient's stay.

Sutter Medical Center, Sacramento's transfusion department is reviewing the need to implement a blood utilization program, which would examine the appropriateness of the blood transfusions their healthcare providers are ordering. While improving patient safety and blood supply conservation are strong incentives to implement the program, the main motivator is as a potential cost savings measure.

The intent of this paper is to review transfused blood components and determine appropriateness based on pre laboratory results, whether there are enough outliers to justify moving forward with the blood utilization program. With this information, Sutter Medical Center will determine whether to move forward with implementing the blood utilization program or look at others ways to potentially reduce costs.

Chapter 1-Introduction

In 2012, the United States spent $2.8 Trillion on healthcare, $882.3 Billion of that was spent on hospital care (The Centers for Medicare & Medicaid Services; National Health Expenditures 2012 Highlights). The Affordable Care Act (ACA) is a healthcare reform bill signed into law in 2010. The goal of the ACA, is to provide more US citizens access to affordable, quality healthcare. (The Staff of The Washington Post, 2010) To provide affordable high quality healthcare to more citizens and to decrease the rate of growth of health care spending, reforms have been enacted to reduce costs while still encouraging quality care. One way to accomplish this is with Medicare reimbursement rates. Instead of paying hospitals and providers based on the services they are providing, reimbursement rates are based on several factors such as patient outcomes, patient satisfaction, readmission rates and how they compare to other hospitals (Centers for Medicare & Medicaid Services; Affordable Care Act Update: Implementing Medicare Cost Savings).

Background and History

The highest cost for the Transfusion Department at Sutter Medical Center, Sacramento (SMCS), is blood products. In 2013, SMCS spent approximately 8 million dollars on blood products. In the past, the department has attempted to reduce costs by streamlining processes and through contract negotiations with their blood supplier, which while it has shown a reduction in cost for the hospital, the savings has not been significant enough to offset other increasing costs that they have incurred. (DeRee, 2014).

In the current healthcare economy, reducing the cost of healthcare and making it more affordable while still providing excellent care has become a major goal for many hospitals.

While contract negotiations are beneficial to reduce cost in the hospital setting, another way to achieve better affordability is by reducing unnecessary procedures.

In a 2008 analysis by McKinsey Global Institute *Accounting for the Cost of U.S. Healthcare*, unnecessary procedures are thought to occur when healthcare providers perform procedures beyond evidence established levels, beyond benchmarks, and by choosing a higher cost service ((IOM), 2010, p. 52). In the Institute of Medicine (IOM) report, there was an estimated $765 billion in waste in 2009 and of that amount $210 billion from unnecessary services ((IOM), 2010, p. 51). Mark Chassin, M.D., the president of The Joint Commission stated "Overuse is a problem resulting from many decisions between doctors and patients. It may result from many factors including payment incentives, time pressures, referral patterns, malpractice fears, patient demand, a culture that has a bias toward 'doing something' rather than not, and an inclination to use technology to solve clinical challenges." (The Joint Commission and the American Medical Association, 2012, p. 6).

September 24, 2012, the Joint Commission and the American Medical Association-Convened Physician Consortium for Performance Improvement organized the National Summit on Overuse which "focused on overuse as a patient safety and quality concern, and endorsed the need to reduce instances of overuse in five specific areas" one of those areas was "over-transfusion of red blood cells (called appropriate blood management for purposes of the summit)" (Proceedings from the National Summit on Overuse)

Research Problem

In order to help make healthcare more affordable, the Transfusion Department at Sutter Medical Center, Sacramento (SMCS) needs to look at ways to reduce cost. Since SMCS spent approximately 8 million dollars last year on blood components, reviewing the opportunities

available, to reduce the amount of blood products purchased each year is an option for potential savings that should be analyzed. Reviewing the healthcare provider's transfusion practices to determine if there is a pattern of unnecessary blood components being ordered for patients, can lead to potential cost reduction for an organization. One way to accomplish this is to implement a blood utilization program which would evaluate and assess the transfusion practices of the SMCS healthcare providers when compared to peer groups using gold standards, which are established by the transfusion medicine field, and indicate when it is necessary to transfuse a patient.

Review Research Question and Hypotheses

While improving patient safety and blood supply conservation are strong incentives, the main motivator for implementing the program is as a potential cost savings measure. For this study I plan to compare the lab results of the patients who have been transfused blood components over a three month period to answer the question: Based on the pre laboratory results, are there enough blood components being transfused, outside scientific based standard guidelines, to justify moving forward with a blood utilization program? In addition, I must discover what percentage of outliers would justify, based on cost, implementing the program. Finally, I will look at other beneficial factors besides cost which could influence SMCS to implement a blood utilization program such as patient safety and proper utilization of the community's blood supply.

The hypothesis of this study is that in order to reduce cost, Sutter Medical Center, Sacramento (SMCS) is justified in implementing a blood utilization program since the healthcare providers are not currently following a defined transfusion policy to determine appropriateness prior to transfusing a patient. This hypothesis is derived from both the personal experience of this

author and the literature on the subject which will be discussed as part of the literature review in the next chapter.

Purpose of study

The purpose of this study is to determine if there is a need to monitor and educate healthcare providers on the appropriateness of transfusing blood components. Sutter Medical Center, Sacramento (SMCS) Transfusion Department is reviewing whether to implement a blood utilization program, which would examine the appropriateness of the blood transfusions their healthcare providers are ordering.

The goal is to use evidence-based criteria, which would determine under what circumstances transfusions would be given, and then to monitor and educate healthcare providers who are giving product outside of the established criteria.

Significance of Study

As a potential cost savings measure, the Transfusion Department at SMCS is evaluating whether to implement a blood utilization program which would review the appropriateness of the blood transfusions ordered, and conclude if the healthcare providers at SMCS are overusing blood components. This paper proposes blood transfusions ordered at Sutter Medical Center, Sacramento (SMCS) during a three month period should be retroactively evaluated for appropriateness by comparing the pre-laboratory results associated with the transfusion. This data can offer insight on whether the organization should move forward with a blood utilization program

Chapter 2 – Literature Review

The purpose of this literature review to cover two areas of emphasis. The first is to discuss the importance of why facilities need to look at transfusion practices. This is done by focusing on three major themes: preserving the community blood supply, cost, and patient safety. The second is to establish scientifically based laboratory transfusion guidelines (triggers). This will be determined by first discussing restrictive and liberal transfusion practices, then by reviewing accredited agencies and their most recent lab value guidelines on when to transfuse blood components.

Blood transfusions have an intricate role in healthcare. They save lives for patients who are in need of blood and offer the opportunity for surgical or other procedures to be performed which otherwise may be impossible without the availability of blood components (Hoeltge, MD, et al., 1999). While blood transfusions are beneficial, they are a finite resource, costly, and risk causing adverse reactions. Two quotes from the review article, "Patient blood management-a new paradigm for transfusion medicine?" (Thomas, Farmer, Hofmann, Isbister, & Shander, 2009), "Blood Services and clinicians need to provide stewardship of this expensive and valuable resource by ensuring that it is used appropriately and for those in greatest need (p. 428) [and] Transfusion is a transplant and should never be a trivial decision." (p. 431) highlights the implications and the importance of the role healthcare providers' play in blood utilization.

Supply

The rise in demand for blood products can be attributed to an "increase in complex surgery and more aggressive treatment of hematological and other malignancies" (Thomas, Farmer, Hofmann, Isbister, & Shander, 2009, p. 424). The Brookhaven National Laboratory posted the following regarding the demand for blood products (2014):

- 4.5 million Americans would die each year without lifesaving blood transfusions.
- Approximately 32,000 pints of blood are used each day in the United States.
- Every three seconds someone needs blood.
- One out of every 10 people entering a hospital needs blood

While the demand for blood products is on the rise, the supply is declining. One of the reasons for the decline in supply is the number of people who are between the ages 16 to 64 are either not donating or are deferred from donating because the donors are not meeting the stringent requirement for donating. The Department of Health and Human Services stated in their 2011 National Blood Collection and Utilization Survey Report that in 2011, "allogeneic blood collection in the US population of individuals aged 16 to 64 was 76.2 units per 1,000 persons" compared with "85.2 units per 1,000" in 2008. According to the report, only "4.5% of the US population aged 16 to 64 donated in 2011" which is a 0.9% drop from 2008 (p. 3). The report also states, "Of the 17, 984, 000 presenting individuals, 2,455,000 were deferred for various reasons". Those reasons include Low Hemoglobin, Prescription drug use, Other Medical Reasons, High Risk Behavior (MSM) (men having sex with other men), High Risk Behavior (Other), Travel, Tattoo/piercing, Other ("low weight, inadequate inter-donation interval, being under the donation age, and language") (pp. 35-36).

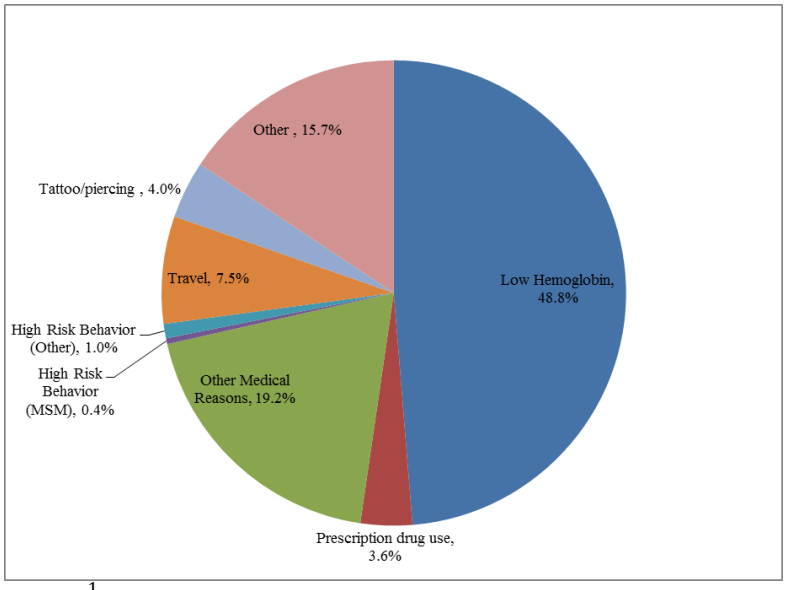


Figure 1- Donor deferrals 2011[1]

The consequence of over utilization of the community's blood supply is either elective surgeries are cancelled or delayed or in an emergency situation, a physician must choose to use alternative blood types, components, or even choose to not use any blood components which may not always be best for the patient and could put them at risk. Of the hospitals participating in the 2011 National Blood Collection and Utilization Survey, 3.3% reported having to delay elective surgeries. The day ranged from one to fourteen with the mean being two (Witaker, PhD, Barbee J; Hinkins, PhD (NORC), Susan, 2011).

Cost

Cost is a second and principal motivator for why transfusion practices should be reviewed. Authors of the 2009 review paper "Patient blood management-a new paradigm for transfusion medicine?" discuss the cost of not only the product itself but the cost of the process as a whole which includes the cost to administer the product. They cite a 2009 study from two Australian teaching hospitals who concluded that the cost of transfusing one unit of RBCs was

[1] (Witaker, PhD, Barbee J; Hinkins, PhD (NORC), Susan, 2011, p. 36)

$700 (Thomas, Farmer, Hofmann, Isbister, & Shander). Another study which was presented at the 2008 American Society of Hematology Meeting in San Francisco, CA reported the cost "$522 and $1183 (mean, $761 ± $294)" (Shander A. H., 2010). In both of these studies, this was for the product and labor cost only and did not include the cost of potential- adverse reactions (Thomas, Farmer, Hofmann, Isbister, & Shander, 2009).

A 2011 study on the cost of blood in the United States (figure 2) breaks down the average cost per blood components hospitals pay to their supplier (Toner, et al., 2011) which correlates with the results from the 2011 Blood Collection and Utilization Survey Report (Witaker, PhD, Barbee J; Hinkins, PhD (NORC), Susan, 2011).

Blood product	n	Means (SD)
Red blood cells	204	$210.74 (38)
Fresh frozen plasma	167	$60.70 (20)
Apheresis platelets	153	$533.90 (69)
Cryoprecipitate	99	$51.28 (18)

Figure 2-Average Blood Component Cost[2]

This cost is for the product only and does not include the additional cost which maybe accrued for modification or additional testing for the blood component. Currently there is an average 1% increase in cost from one year to the next (Witaker, PhD, Barbee J; Hinkins, PhD (NORC), Susan, 2011) but this is not always the case; from 2001 to 2004, there was a 31% increase in the cost of blood products mainly due to increased testing, distribution, recruitment and general cost of running a blood collection center (Toner, et al., 2011).

While the cost of blood components continues to rise, the reimbursement from insurance companies "frequently lag[s] far behind the actual cost of procuring state- of- the- art blood

[2] Modified from Table 1. Statistics on acquisition costs and charges by blood component ($US, year 2007 values) (Toner, et al., 2011).

components and services" (Ness, 2003). The largest disproportion is with Red Blood Cells (RBC), in 2011 the Department of Health and Human Services reported the average cost for a RBC was $225.42; the average reimbursement rate by the Centers for Medicare and Medicaid Services was $194.86, which is a -13.6% reimbursement rate (Witaker, PhD, Barbee J; Hinkins, PhD (NORC), Susan, 2011).

In 1970 U.S. blood banks, move toward an all-volunteer blood donor system with the intention of creating a safer community blood supply (American Red Cross). There are those in the community who wonder if blood centers get their blood for free, then why does it cost so much for a unit of blood. The cost represents an accumulation of costs incurred by the blood supplier, such as donor recruitment, the staff who collect, process, and ensure the safety of the blood supply, and supplies needed to collected and process the blood products (Toner, et al., 2011). The largest cost though comes from testing both for blood types but also for blood-transmitted infectious diseases like Hepatitis C (HCV) and human immunodeficiency virus (HIV) (AABB, the American Red Cross, America's Blood, 2013). Even though sources believe the blood supply is safer than ever, they all agree that it is not 100% safe and that as new scientific discoveries are achieved to reduce the risks of receiving blood, the cost of those products will continue to rise.

Risk

A blood transfusion introduces a foreign substance, or "transplant" into the body which puts a patient at risk for transfusion induced complications. Transfusion risks include but are not limited to developing antibodies to transfused red blood cells making it more difficult to find compatible products in the future, suppressed immune system, increased risk to infections, transmitted infectious diseases, and adverse reaction to the transfusion. In a 2008 review of 45

studies which evaluated the risks of blood transfusion, 42 studies showed a significant link to mortality, infection, or adult respiratory distress syndrome (Marik & Corwin). Reducing the potential risk to the patient is the third sub-theme; this can be divided into three categories: infectious risks, non-infectious risks, and immunologic consequences.

Infectious risks are a transfusion transmitted infections (Thomas, Farmer, Hofmann, Isbister, & Shander, 2009, p. 425). While blood components are highly regulated and go through vigorous testing, there is always a risk of a transfusion transmitted infection. According Thomas, Farmer, Hofmann, Isbister, & Shander, "transfusion associated sepsis is the most common causes of death from the transfusion-transmitted infections". In this 2009 article, the authors state that the risks for transfusion associated sepsis were "one in 75,000 for platelets and one in 500,0000 for red cell transfusion" (Thomas, Farmer, Hofmann, Isbister, & Shander, 2009, p. 425).

Some of those infectious risks also come from viruses, some of which have not been discovered. In the 1980's, the healthcare community discovered HIV/AIDs, HCV, and HBV and realized these viruses were not only infectious but could be transmitted through blood products. With this realization, regulations have been put in place for the following tests and screenings to be performed: human immunodeficiency virus (anti-HIV-1/2), hepatitis C virus (anti-HCV), human T-cell lymphotropic virus (anti-HTLV-I/II), hepatitis B core antigen (anti-HBc), hepatitis B surface antigen (HBsAg), HCV ribonucleic acid (RNA), HIV-1 RNA, West Nile virus (WNV) for HBV DNA and serologic testing for syphilis (AABB, the American Red Cross, America's Blood, 2013). With the regulation for the additional testing, the cost for blood components increases and the supply pool for blood components are reduced. Unfortunately, there are still unknown and untested infectious diseases out there, and while blood products are "safer than it

has ever been" there are still transfusion-transmitted infections risks associated with blood transfusions. (Thomas, Farmer, Hofmann, Isbister, & Shander, 2009, p. 426)

As stated in the earlier paragraph, with additional testing for infectious risks, transfusions are becoming safer, but in addition to infectious risks, there are also non-infectious risks. Non-infectious risk include transfusion reactions, incorrect/incompatible blood components transfused due to human error, and other general adverse outcomes, for example, increased incidence of post-operative infections, increased hospital length of stay and increased morbidity and mortality (Thomas, Farmer, Hofmann, Isbister, & Shander, 2009). Because a blood transfusion introduces a foreign substance into the body, the body's immune system may see it as an invasion causing the body to respond. This response maybe as mild as a low grade fever to potentially massive activation of the immune system and clotting system which can lead to shock, kidney failure, circulatory collapse, and death (Laura Dean, 2005).

"A reaction is defined as an undesirable response or effect in a patient that is temporally associated with the administration of blood or blood component(s) and that may or may not be the result of an incident or an interaction between a recipient and the blood product" (Witaker, PhD, Barbee J; Hinkins, PhD (NORC), Susan, 2011, p. 48). The 2011 National Blood Collection and Utilization Survey stated in 2011, there were 50,570 or 1:414 transfusions reported transfusion-related adverse reactions (Figure 3). In much of the literature, the general consensus is that non-infectious risks are under reported. It is suspected this is due to healthcare providers' lack of education and experience regarding transfusions (Frank, et al., 2012) and because symptoms can occur anywhere from minutes to weeks after the patient is transfused, and they may be attributed to the patients underlying condition and not to the transfusion (Centers for

Disease Control and Prevention, 2013; Elizabeth A. Katz, 2009; Sharma, M.D., Sharma, M.D., & Tyler, M.D., 2011; Witaker, PhD, Barbee J; Hinkins, PhD (NORC), Susan, 2011).

The most common transfusion reactions are Febrile, which symptoms include chills, fever, shaking, and aching, and Allergic, "results from an interaction of an allergen in the transfused blood with preformed antibodies in the person receiving the blood transfusion" (Centers for Disease Control and Prevention, 2013), patient feels itchy and may break out into hives (Witaker, PhD, Barbee J; Hinkins, PhD (NORC), Susan, 2011; Laura Dean, 2005; Elizabeth A. Katz, 2009). While both of these reactions are generally not fatal, they do put additional stress on the patient's system, which could impede their healing process.

Table 8-2. Transfusion-Related Adverse Reactions Reported to the Transfusion Service

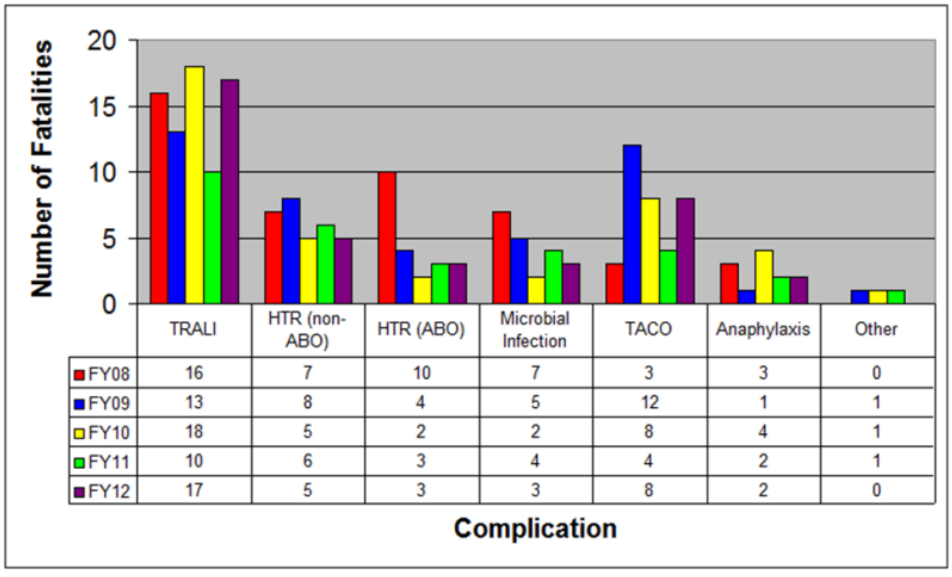
Adverse Transfusion Reactions	Number of Occurrences 2011	2011 Reactions: Components Transfused (n=20,933,000 total components)
Total number of reactions that required any diagnostic or therapeutic intervention	50,570	1:414
Febrile, nonhemolytic transfusion reaction	21,865	1:957
Mild to moderate allergic reactions	14,106	1:1,484
Delayed serologic transfusion reaction	2,560	1:8,178
Transfusion-associated circulatory overload (TACO)	1,512	1:13,843
Hypotensive transfusion reaction	1,132	1:18,494
Delayed hemolytic transfusion reaction	1,018	1:20,569
Transfusion-associated dyspnea (TAD)	909	1:23,023
Severe allergic reactions	491	1:42,647
Transfusion-related acute lung injury (TRALI)	327	1:63,940
Post Transfusion Purpura	209	1:100,001
Acute hemolysis (due to other causes)	168	1:124,525
Posttransfusion sepsis	59	1:353,138
Acute hemolysis (due to ABO incompatibility)	42	1:495,207
Posttransfusion virus transmission	36	1:585,726
Transfusion-associated graft-vs-host disease	22	1:931,398
Reactions that were life-threatening, requiring major medical intervention following the transfusion; eg, vasopressors, blood pressure support, intubation, or transfer to the ICU	317	1:66,131

Figure 3[3]

In a 2012 report by the FDA 74 fatalities were reported to be due to transfusions from October 1, 2011, through September 30, 2012. Of those 74 fatalities, the FDA ruled "38 (51%) of the fatalities were transfusion-related, 27 (36%) of the fatalities were cases in which

[3] Chart retrieved from (Witaker, PhD, Barbee J; Hinkins, PhD (NORC), Susan, 2011, p. 49)

transfusion could not be ruled out as the cause of the fatality, 9 (12%) of the fatalities were unrelated to the transfusion" (Fatalities Reported to FDA Following Blood Collection and Transfusion: Annual Summary for Fiscal Year 2012). Figure 4 shows the breakdown of the transfusion related fatalities from 2008 to 2012. Transfusion-related acute lung injury (TRALI), a serious but rare reaction that occurs when fluid builds up in the lungs, has been the leading cause of transfusion-related deaths reported to the FDA (Centers for Disease Control and Prevention, 2013; U.S. Food and Drug Administration, 2012; Elizabeth A. Katz, 2009). Even though TRALI has been recognized since the 1950s and has been widely studied, researchers still do not fully understand the causes of a TRALI reaction, but it is thought to be associated with the presence of antibodies in donor blood (Elizabeth A. Katz, 2009; U.S. Food and Drug Administration, 2012; Centers for Disease Control and Prevention, 2013).



	TRALI	HTR (non-ABO)	HTR (ABO)	Microbial Infection	TACO	Anaphylaxis	Other
FY08	16	7	10	7	3	3	0
FY09	13	8	4	5	12	1	1
FY10	18	5	2	2	8	4	1
FY11	10	6	3	4	4	2	1
FY12	17	5	3	3	8	2	0

Figure 4[4]

While transfusions are beneficial, there are also both infectious risks and non-infectious risks. The costs of these risks are not only monetary, increase stay in the hospital and or additional treatment, but also the patients' health. There are ways to reduce chances of a patient

[4] Chart retrieved from Fatalities Reported to FDA Following Blood Collection and Transfusion: Annual Summary for Fiscal Year 2012 (U.S. Food and Drug Administration, 2012)

having an adverse reaction to receiving blood products such as additional testing for blood transferred infections and pre-medicating patients with antihistamines to avoid allergic reactions, but the best way to reduce the risks to reduce exposure to blood products by only transfusing a patient when it is absolutely necessary.

Transfusion Triggers

The first human to human blood transfusion was done in the 1800s by James Blundell (American Red Cross, 2014). During the early 1900s, huge strides in transfusion medicine were developed to the point where blood transfusions were considered to be ‘a procedure of such simple and harmless character” (Bertram M.Fiernheim, 1917, p. xiv) that no clinical indication was needed, “the mere possibility of benefitting a condition by the addition of blood being considered sufficient warrant’ (Bertram M.Fiernheim, 1917, p. 46; Shelley R. Salpeter, 2014). Many times when a physician makes the decision to transfuse a patient, it is based on “tradition and anecdotal experience” not on science (Thomas, Farmer, Hofmann, Isbister, & Shander, 2009, p. 424). Steven M. Frank, M.D., an associate professor of anesthesiology and critical care medicine at the Johns Hopkins University School of Medicine, states, “A lot of our practices are just handed down through the generations.” (Johns Hopkins , 2012) In his study conducted at Johns Hopkins Hospital, Dr. Frank and his associates found transfusion rates varied up to threefold between different physicians performing the same procedure and that the average transfusion hemoglobin trigger used to determine the need for blood transfusion was widely varied (Frank, et al., 2012). The reason for this variation is due to a lack of physician education in Transfusion Medicine (Arinsburg, Skerrett, & Friedman, 2012; Rock, Berger, Pinkerton, & Fernandes, 2002; Friedman; (IOM), 2010)

The belief of more is better approach in Transfusion Medicine is the basis of liberal transfusion practices. As stated earlier, sometimes the risks of a transfusion can outweigh the benefits and while there are those who believe withholding transfusions could harm patients, there have been multiple randomized controlled studies done that have proven that transfusing at lower thresholds is safe and can reduce the number of transfused blood components (Hebert, M.D., et al., 1999; Marik & Corwin , 2008; Shelley R. Salpeter, 2014; Carson, et al., 2011).

All transfusions should be based on the patient's current condition, but laboratory values should also be used as a guideline for healthcare providers to help determine if their patient should be transfused especially in patients who are stable. For Red Blood Cells (RBC) the patient's hemoglobin (Hgb) levels help determine the need for transfusion. In the past, a 10 g/dL Hgb was the lab value trigger for when to transfuse, but studies (see Figure 5 and Figure 6) have determined that transfusions of RBCs should be considered when the patient's Hgb is $\leq$ 7 to 8 g/dL depending on patient diagnosis (Szczepiorkowshi & Dunbar, 2013). These studies and others have shown transfusing patients and the lower threshold is not detrimental to the patient's recovery and has the added benefit of reducing the risk of a possible adverse reaction.

For plasma transfusions (FFP), the Transfusion Practices Committee of the AABB recommended plasma to be transfused only in a few cases those being trauma patients with server bleeding, "patients undergoing complex cardiovascular surgery," and patient's on warfarin therapy with intracranial bleeding (Goodnough, M.D. & Shander, M.D., 2012). Other studies also, include plasma to be used as replacement apheresis in patients with Thrombotic thrombocytopenic purpura, congenital or acquired hemophilia, and patients with unusual plasma

Table 1. Selected recent multicenter randomized, controlled trials informing RBC guidelines

Study	Design (N)	Population	Transfusion threshold	Primary outcome(s)	Secondary outcome(s)	General conclusions
Hebert et al[9] (TRICC)	RCT (838)	Stable, critically ill patients > 16 y of age with Hb < 9 g/dL	Restrictive (Hb < 7 g/dL) vs liberal (Hb < 10 g/dL)	Death within 30 d of randomization	Death at 60 d, assessment of organ dysfunction	Restrictive transfusion strategy is at least as effective and possibly superior to a liberal transfusion strategy with the possible exception of patients with acute myocardial infarction or unstable angina
Lacroix et al[10] (TRIPICU)	RCT (637)	Stable, critically ill children with Hb < 9.5 g/dL	Restrictive (Hb < 7 g/dL) vs liberal (Hb < 9.5 g/dL)	Death within 28 d of randomization, development or progression of MODS	Daily assessment of organ dysfunction, sepsis, transfusion reactions, infections, adverse events, length of stay, overall mortality	Restrictive transfusion strategy decreases transfusion requirements without increasing adverse events
Carson et al[11] (FOCUS)	RCT (2016)	Adults > 50 y of age with history or risk factors for cardiovascular disease with Hb < 10 g/dL after hip fracture surgery	Restrictive (Hb < 8 g/dL) vs liberal (Hb < 10 g/dL)	Death or inability to walk across a room at 60 d follow-up	In-hospital myocardial infarction, unstable angina, or death	Liberal transfusion strategy did not reduce rate of death or inability to walk at 60 d follow-up
Villanueva et al[4]	RCT (921)	Adult patients with severe upper gastrointestinal bleeding	Restrictive (Hb < 7 g/dL) vs liberal (Hb < 9 g/dL)	Death within 45 d of randomization	Rates of further bleeding or hospital complications	Restrictive transfusion strategy was associated with improved outcomes

MODS indicates multiple-organ dysfunction syndrome; FOCUS, Transfusion Trigger Trial for Functional Outcomes in Cardiovascular Patients Undergoing Surgical hip Fracture Repair; RCT, randomized, controlled trial; TRICC, Transfusion Requirements in Critical Care; and TRIPICU, Transfusion Requirements in Pediatric Intensive Care Unit.

Figure 5-Studies for Restrictive vs. Liberal transfusion thresholds[5]

Table I - Transfusion guidelines at a glance. A side-by-side comparison of key provisions of transfusion guidelines.

	CAP (1998)[68]	ASA (2006)[69]	STS (2007)[70]	SCCM (2009)[32]	SIMTI (2011)[71-73]	AABB (2012)[74]
Target population	General	Perioperative (general)	Cardiac surgery	Critically ill	Perioperative (general)	Hospitalised, haemodynamically stable
RBC usually indicated	Hb <6 g/dL	Hb <6 g/dL	Hb <6 g/dL (Hb <7 g/dL in postoperative patients and higher if risk of end-organ ischaemia)	Hb <7 g/dL if ventilated, trauma, or stable cardiac disease (Hb <8 g/dL in acute coronary syndrome)	Hb <6 g/dL (Hb 6-8 g/dL if risk factors present; Hb 6-10 g/dL if symptoms of hypoxia present)	Hb ≤7 g/dL in critically-ill patients; Hb ≤8 g/dL in surgical patients, or patients with pre-existing cardiovascular disease; When symptoms are present
RBC rarely indicated	Hb >10 g/dL	Hb >10 g/dL	Hb >10 g/dL	Hb >10 g/dL	Hb >10 g/dL	
Equivocal	Hb 6-10 g/dL	Hb 6-10 g/dL				Patients with acute coronary syndrome
Factors to consider in making the decision	Peripheral tissue oxygenation, clinical signs and symptoms, Hb, extent/rate of bleeding	Ischaemia, extent/ rate of bleeding, volume status, risk factors for hypoxia complications	Age, severity of illness, cardiac function, ischaemia, extent/ rate of blood loss, Hb, SVO_2	Volume status, shock, duration/ extent of anaemia, cardiopulmonary parameters	Rate of blood loss, Hb level, risk factors, symptoms of hypoxia/ ischaemia	Hb levels as well as symptoms (chest pain, orthostatic hypotension, unresponsive tachycardia, heart failure)

Legend AABB: American Association of Blood Banks; ASA: American Society of Anesthesiologists; CAP: College of American Pathologists; Hb: haemoglobin; SCCM: Society of Critical Care Medicine; SIMTI: Italian Society of Transfusion Medicine and Immunohaematology; STS: Society of Thoracic Surgeons; SVO_2: mixed venous oxygen saturation.

Figure 6- Regulatory agencies Red Blood Cell transfusion guidelines [6]

[5] Table retrieved from journal article "Transfusion guidelines: when to transfuse" (Szczepiorkowshi & Dunbar, 2013)

[6] Chart Retrieved from "A new perspective on best transfusion practices" (Shander, Gross, Hill, Javidroozi , & Sledge, 2012)

protein deficiencies with specific pharmacological therapy that is not available (Sharma, M.D., Sharma, M.D., & Tyler, M.D., 2011). The reviewed studies have a varied range of the international normalized ratio (INR) for the threshold (1.5-1.7) of when FFP should be given the consensus is for a patient not meeting the previous stated conditions should not be given plasma if the INR is below the threshold trigger (Goodnough, M.D. & Shander, M.D., 2012; Sharma, M.D., Sharma, M.D., & Tyler, M.D., 2011; Holland, M.D. & Brools, M.D., MBA, 2006; Cooper, et al., 1994).

Platelet transfusions are used to help prevent or reduce bleeding related to low platelet counts and/or dysfunctional platelets. Bleeding can result from a number of disorders and treatments such as leukemia, chemotherapeutic drugs, and anti-platelet medications (Blood Source, 2012). Bleeding normally does not occur unless the platelet count is no greater than 5×10^3 per μL (Blood Source, 2012; Sharma, M.D., Sharma, M.D., & Tyler, M.D., 2011). "One randomized controlled trial evaluated a threshold for prophylactic platelet transfusion in patients with acute myeloid leukemia. Patients were randomized based on platelet transfusion triggers of 10×10^3 per μL or 20×10^3 per μL. Patients in the lower trigger group received 21.5 percent fewer transfusions than the higher trigger group. Gastrointestinal bleeding was more common in the lower trigger group; however, there was no difference in blood transfusions between groups" (Figure 7) (Sharma, M.D., Sharma, M.D., & Tyler, M.D., 2011). Even though bleeding does not normally occur until platelet count is $< 5 \times 10^3$, unless the patient has underlying conditions like leukemia, or they are on chemotherapeutic drugs and anti-platelet medications, the transfusion trigger for stable patient in the hospital is $\leq 50 \times 10^3$ (Blood Source, 2012; Sharma, M.D., Sharma, M.D., & Tyler, M.D., 2011).

Prophylactic transfusion indications	*Platelet count (x 10^3 per µL)*
Major surgery or invasive procedure, no active bleeding	≤ 50
Ocular surgery or neurosurgery, no active bleeding	≤ 100
Surgery with active bleeding	< 50 (usually) > 100 (rarely)
Stable, nonbleeding	< 10
Stable, nonbleeding, and body temperature > 100.4°F (38°C) or undergoing invasive procedure	< 20

Figure 7-Indications for Transfusion of Platelets in Adult[7]

Laboratory values in a patient blood utilization program are just the beginning. The lab values provide only a very narrow view of blood use appropriateness. A patient blood utilization program entails looking not only at the lab values, but also at the patient's chart to determine if there are other things going on with him/her which would indicate a need for a patient to be transfused. Before implementing a blood utilization program though, data needs to be reviewed to substantiate the need for such a program. The best way to accomplish this is to first look at the laboratory values. For Sutter Medical Center, Sacramento, the question that needs to be answered is based on current transfusion practices what percentage of transfused blood components fall outside of the evidence-based recommended guidelines.

[7] Table taken from journal article "Transfusion of Blood and Blood Products" (Sharma, M.D., Sharma, M.D., & Tyler, M.D., 2011)

Chapter 3- Research Methodology

Research Design

To justify introducing a blood utilization program at Sutter Medical Center, Sacramento, the research first started out with literature reviews to determine why a program was needed and what would be the determining factors to judge when it was appropriate to transfuse blood. The literature mainly focused on four main themes: cost, supply, risk, and the criteria for when a transfusion was needed.

From the literature review, a case study research project was developed. The research methodology required gathering both primary quantitative and qualitative relevant data, though the quantitative is the main source to support the hypothesis: In order to reduce cost, SMCS is justified in implementing a blood utilization program since the healthcare providers are not currently following a defined transfusion policy to determine appropriateness prior to transfusing a patient. The qualitative data is used to support the need to implement a blood utilization program, not only to reduce cost but to show other factors besides cost which could influence the decision to implement the program.

The results of the study should provide evidence to either support or not support the research hypothesis and gather insight on additional factors, which could influence the development of the project. These conclusions provided by the research project will be used to make recommendations on whether SMCS should move forward with implementing a blood utilization program or should they look elsewhere for cost savings. While the data being collected will not be able to be used in establishing the need for a similar program at other healthcare facilities, the research plan could be used by those facilities to see if they too could justify having a similar program.

Research Purpose

The purpose of this study was to gather information that either supported or did not support the hypothesis: in order to reduce cost, Sutter Medical Center, Sacramento (SMCS) is justified in implementing a blood utilization program since the healthcare providers are not currently following a defined transfusion policy to determine appropriateness prior to transfusing a patient.

This was done by reviewing the quantitative data from a random sampling of transfused blood components and the corresponding patient's laboratory values. This was examined to ascertain the number of blood products transfused outside of the recommended laboratory value trigger and used to determine if there were enough outliers to justify implementing a blood utilization program. In addition, a qualitative evaluation was utilized for this research project using subjective methods such as online interviews and survey questions. This qualitative primary data was used to get the perspective of the participants on the following questions:

1. What percentage of possible reduction in blood products would be considered enough to implement a utilization program?
2. Are there other factors besides cost which could sway the decision to implement the program?
3. What are other hospitals doing about patient blood utilization?
4. What is the perception of how SMCS is doing at patient blood utilization?
5. What is the perception of how important is patient blood utilization?
6. What are the advantages and disadvantages of a patient blood utilization program?

Dependent and Independent Variables

Dependent Variables

- Cost- Dependent Variable

Independent Variables

- Evidence-based transfusion guidelines
- Implementing a blood utilization program
- Quantity of Blood Usage

The dependent variable cost, for this research project, is cost, i.e., how much Sutter Medical Center, Sacramento is paying annually for blood products. The three independent variables are: 1.) evidence-based transfusion guidelines, whether or not healthcare providers using these guidelines, 2.) implementation of a blood utilization program, and 3.) quantity of blood usage. All three independent variables can have an effect on the cost. For example, if the quantity of blood used goes down, then the amount SMCS pays for products also decreases. The number of healthcare providers using evidence-based transfusion guidelines could also reduce the amount of blood used which could also reduce the cost. Finally, implementing a blood utilization program could encourage more healthcare providers to use evidence-based transfusion guidelines which would reduce the number of blood components used and ultimately affect the amount SMCS is paying for blood components.

Data Collection Process Overview

First, a database of patient blood transfusions audit was completed to determine if there are enough blood components being transfused, outside science-based standards guidelines to justify moving forward with a blood utilization program. This is accomplished by pulling reports from SMCS's laboratory information (LIS) (Sunquest Information Systems, INC., Tucson

Arizona) for January 1, 2014 thru March 31, 2014 which showed all the blood components transfused to patients during this time frame. Initially, the project's design was to examine and evaluate every unit transfused during the three month period, but due to time constraints and the amount of time to manually collect this data, the study was changed to evaluate only a sample the blood components transfused during this time.

Five-thousand blood components were transfused during the three-month period. Seven hundred and twenty-five blood components were randomly selected to give a meaningful representation. This was accomplished by the researcher pulling issued blood component units from five days representing a Monday through Friday week. Each day was picked from a different week in the month except for February which had two days representing Monday and Friday since there were only four weeks in the month. Patients who had received more than ten units of blood components during the day selected were excluded from the study. The trigger threshold lab value standards are based on patients who are hemodynamically stable. Patients who have received ten or more blood components during a twenty-four- hour period are not considered stable.

The blood component data was summarized on an excel worksheet along with the diagnosis of the patient; the name of the ordering physician was also given. Date and time that the product was issued was manually looked up in the LIS and entered on to the excel worksheet. Once the date and time of blood component issue was established, the most current pre-transfusion lab values were pulled from the (LIS) and manually entered onto the worksheet. Based on standard recommended transfusion practices guidelines from the literature review and from SMCS's current policy on determining transfusion criteria, the following tests were used for the pre- lab values: Hemoglobin (HGB) for packed red blood cell (pRBC) transfusions,

Platelet count for platelet transfusions, and International Normalized Ratio (INR) fresh frozen plasma (FFP) transfusions. Those values were then compared to the trigger thresholds to determine when a transfusion was needed. The trigger thresholds were derived from SMCS's blood supplier's recommendation, peer reviewed literature, and standards set by the AABB (formally known as the American Association of Blood Banks.

Finally, qualitative data was gathered from online interviews and surveys, to get the viewpoints of those working in Transfusion Medicine. This data was collected using the following methods:

- Transfusion Supervisors at SMCS and other area hospitals–online interview questions were emailed to the participants.(Appendix A)
- Blood Supplier–online interview questions were emailed to head pathologist. (Appendix B)
- Regional Laboratory Director for the Sacramento Sierra Region–online interview question was emailed to the participant. (Appendix C)
- Clinical Laboratory Scientist–survey was emailed to all of the Clinical Laboratory Scientists who work in the Transfusion Department at SMCS. (Appendix D)

This qualitative data will be used to establish the answers to the questions mentioned in the above section about research development.

Research Limitations and Validity

Time was a noteworthy research limitation. For the audit reviewed earlier in the paper, instead of being able to compile data for a full three month period, the researcher extracted a random sampling of the units. To control for validity and to remove potential bias, the researcher developed a method for obtaining the audit data by using a formula in which the data was

randomly selected from the days of the week to equal five days per month or fifteen days total. For each week of the month, one day was selected. Holidays and weekends were exempt since they would not represent an average day. February had two days in one of the weeks used due to the shortened month.

The limitations for data from the interview questions include both time and limited interviewees. Interview questionnaires were emailed to seven respondents, but due to unforeseen circumstances, only five were returned. One of the seven respondents was no longer an employee of the healthcare facility, and the other respondent took a leave of absence. To reduce limitation for future research, a wider interviewing audience should be obtained in order to get a wider range of viewpoints. There was no threat to internal validity in this situation. The interview questions were written to avoid projecting the researcher's bias, and the interviews did not have contact with each other to influence their responses.

Of the surveys sent to the Clinical Laboratory Scientist (CLS) at SMCS, twenty-four of the twenty-nine responded. Two respondents were either on vacation or maternity leave, and the other three did not respond. The threat to internal validity with the survey was minimal; the questions were written to avoid projecting the researcher's bias. Because the researcher works closely with those who participated in the survey, the researcher had to remove herself from conversations regarding the survey until after the surveys had been completed. Validity was the potential for the CLSs discussing the survey among themselves. While there is nothing to substantiate conversations regarding the survey did happen, there is a possibility which could have influenced the responses to the survey.

Chapter 4-Results and Findings

Audit Results

January through March, Seven hundred and twenty-five blood components were audited for appropriateness based on the most recent pre-transfusion lab value which corresponded with the type of blood component being transfused. The data was based on the following (Figure 8)

Blood Component	Lab Test	Lab Value Criteria for when to transfuse
Red Blood Cell (RBC)	HGB	≤ 8 g/dl
Fresh Frozen Plasma (FFP)	INR	> 1.6
Platelet	PLT	< $50x10^3$ per µl

Figure 8

The results of the audit were as follows:

January 248 blood components were reviewed 92 (37%) were Transfused outside of the lab value based criteria. (Figure 9 and Figure 10)

January	Transfused outside of Guidelines	Total Number Used for Study	Cost units Transfused outside of the Guidelines[8]
RBC	61	180	$12,855.14
FFP	9	37	$546.30
Platelets	22	31	$11,745.80

Figure 9- Breakdown of January Audit

[8] The price per unit of blood components is considered proprietary and could not be used for this study. Cost per unit is based on the 2011 study Costs to hospitals of acquiring and processing blood in the U.S. (Toner, et al.)

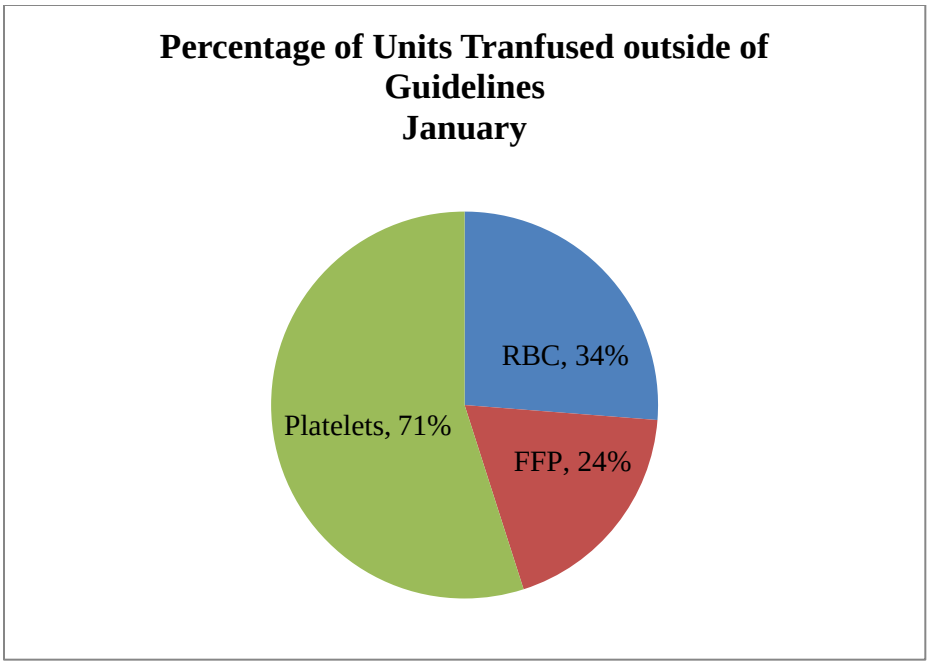


Figure 10

February 231 blood components were reviewed 97 (42%) were Transfused outside of the lab value based criteria. (Figure 11 and Figure 12)

February	**Transfused outside of Guidelines**	**Total Number Used for Study**	**Cost units Transfused outside of the Guidelines[8]**
RBC	66	177	$13,908.84
FFP	13	26	$789.10
Platelets	18	28	$9,610.20

Figure 11 Breakdown of February Audit

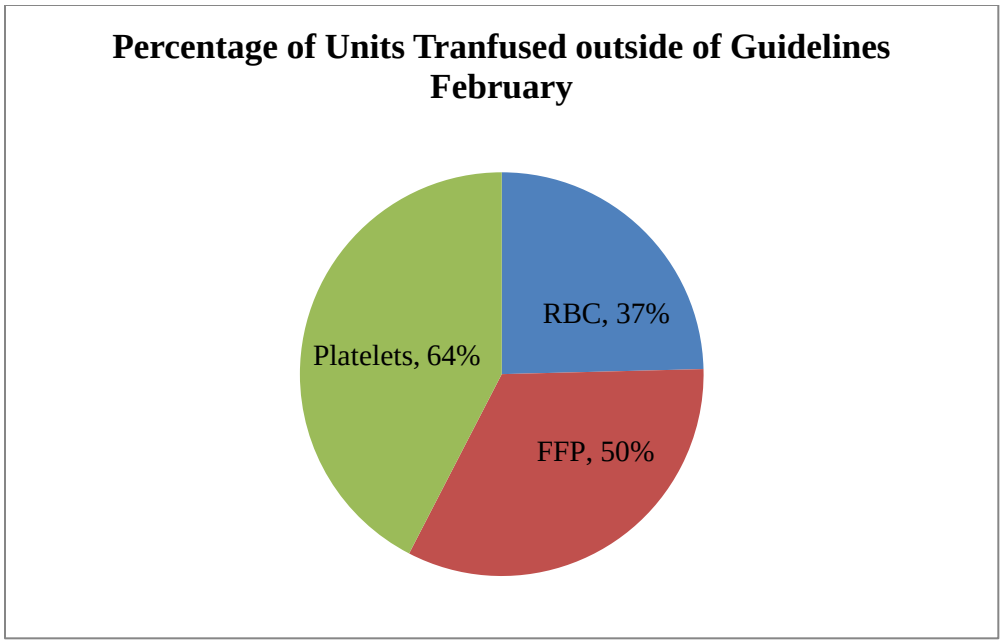


Figure 12

March 257 blood components were reviewed 100 (39%) were Transfused outside of the lab value based criteria. (Figure 13 and Figure 14)

March	**Transfused outside of Guidelines**	**Total Number Used for Study**	**Cost units Transfused outside of the Guidelines[8]**
RBC	66	186	$13,908.84
FFP	14	44	$849.80
Platelets	20	27	$10,678.00

Figure 13 Breakdown of March Audit

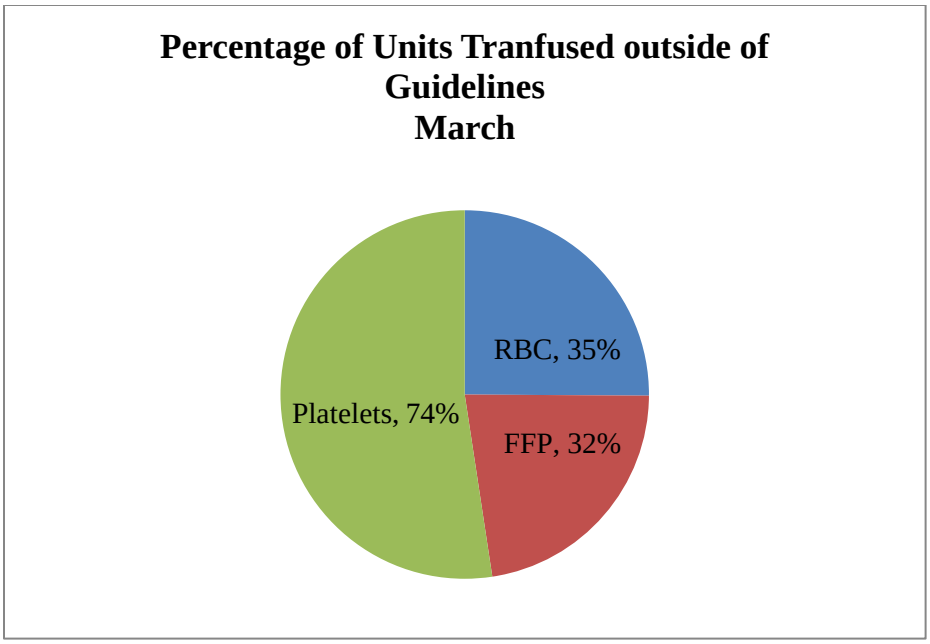


Figure 14

Figure 15 compares by blood components the totals of all three months

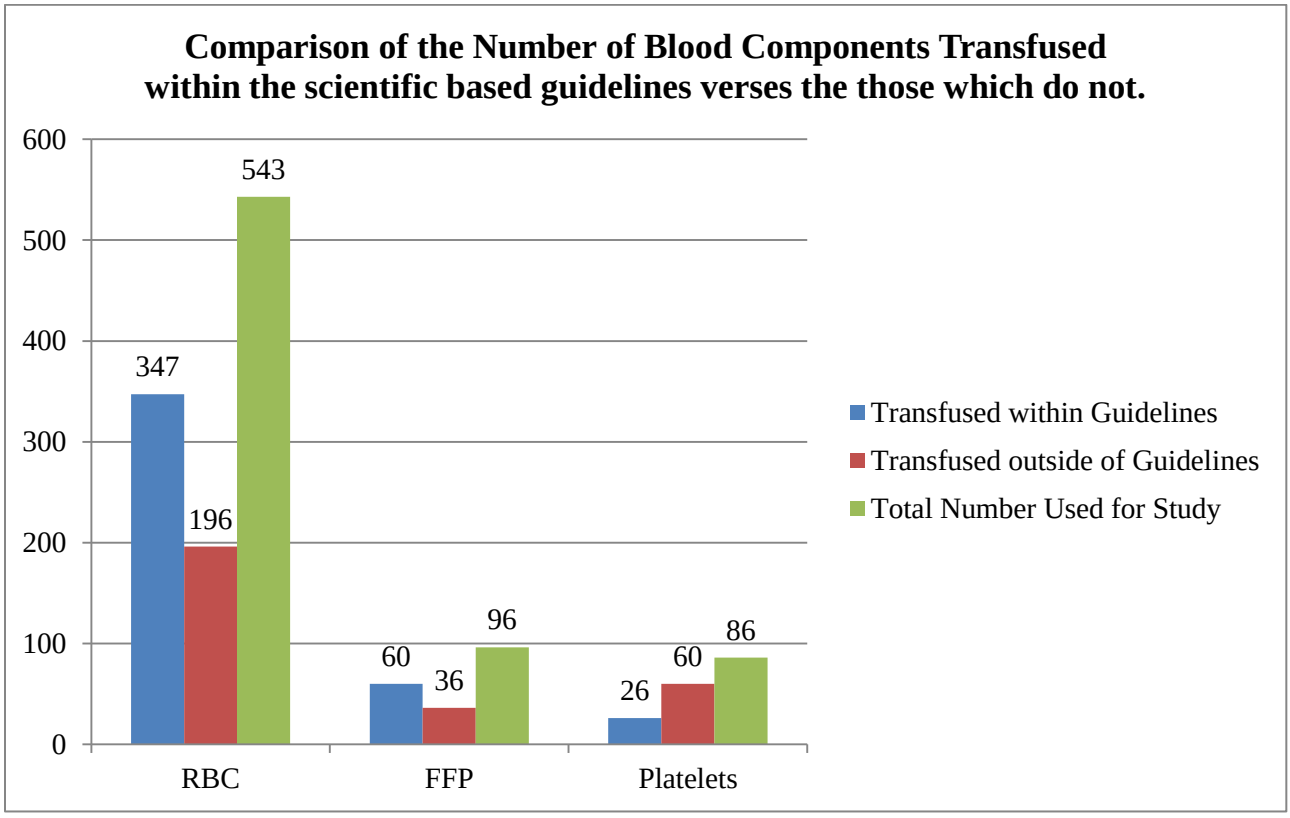


Figure 15

Key Audit Findings

The data used for the audit was a little over 10% of the total number of blood components transfused during the time frame. While it was worrisome, this would not be enough of a representation to get a clear picture of the Transfusion practices at SMCS, yet it did show some very significant findings. The first was the volume of units transfused outside of the lab value based Transfusion criteria. While the lab values are not the only criteria a healthcare provider must consider when transfusing a patient, it is considered a significant part of the decision processes. Based strictly on these numbers, the potential amount spent on overuse for the three month time frame is approximately $74,892[8].

In addition to the total volume of units being transfused outside of the lab value criteria, they are spread out fairly equally from month to month. Except for the FFP in January which was 9 compared to February- 13 and March-14, the numbers of outlying transfused blood components are fairly consistent from month to month. This could suggest a pattern which could carry through the rest of the year.

Finally, it was somewhat of a surprise to see the number of platelets being transfused outside of the lab value criteria for when to transfuse platelets. It is the only product where the outliers are greater than those being transfused within the guidelines. This could suggest two things, either the healthcare providers are choosing other criteria to base when to transfuse platelets or they have not been given resources to understand when it is appropriate to transfuse a platelet. This would be an excellent area for a Blood Utilization Program to look at since platelets are the most expensive blood component costing approximately $533.90 per unit (Toner, et al., 2011; Witaker, PhD, Barbee J; Hinkins, PhD (NORC), Susan, 2011)

Interview Questions for the Supervisor or Leads in Transfusion Departments

This set of interview questions was sent to the Transfusion Supervisor of SMCS and to four other Transfusion Supervisors or Leads from the area hospitals (See Appendix A). These interview questions were to get a perspective on what Sutter is currently doing in blood utilization and to see if the area hospitals have implemented any programs. Out of the five surveys sent, only three were returned.

Question 1: Who, if anyone, does your facility provide formal transfusion training?

All three respondents stated only the new hire Clinical Laboratory Scientist receive any formal transfusion training which in done as part and the initial training process.

One respondent also expressed that to their knowledge no formal training was given to the physicians practicing at their facility.

Question two: What transfusion guidelines does your institution use?

Response 1: "Sac-Sierra Transfusion Audit Criteria established March 2007:

RBC=HGB <8, Hypovolemia, Systematic anemia, Red Cell exchange or Pre-kidney transplant

FFP=INR or PTT ratio <1.5, Bleeding with coagulopathy, Emergency Warfarin reversal, Plasma exchange, unexplained intraoperative bleeding with inadequate time for workup

PLTS= Non bleeding patient <10,000, Bleeding with count of <20,000, abnormal PFA, invasive procedure into close space with abnormal PFA or count <100,000"

Response 2: "We follow AABB guidelines, even though this facility is not AABB inspected (at least one of our sister facilities is an AABB Transfusion Service). Other guidelines are followed regionally (within AABB Standards), and our policies and procedures are regional."

Response 3: "We currently are using regional guidelines which are based on scientific research and supported by the AABB."

Question 2: What does your patient blood management (PBM) or Blood Utilization program entail?

Response 1: "Regional Annual Chart Audit of minimal number of randomly selected charts"

Response 2: stated no formal blood utilization program in place but a "committee meets bimonthly, and includes the Pathologist, Laboratory Transfusion Service Supervisor, a General Surgeon, and OB/GYN and an Oncologist" to discuss blood usage and wastage at their facility.

Response 3: "There is currently no formal blood management program put in place. To meet the requirements put in place by the Joint Commission there is a Blood Utilization committee in place which reviews the number of blood components being transfused, wasted and the number of adverse reactions. In addition, annually a small number of patient charts are "randomly" selected and reviewed by the Risk department to determine if it was appropriate for a patient to receive a transfusion, this is then reported back to the state."

Question 4: Who, if anyone, does your facility provide formal PBM training?

All three respondents replied that there was no formal PBM training at their facility.

Question 5: How does your hospital measure the success of interventions implemented to improve patient blood management?

Response 1: "patient charts are reviewed on a monthly basis, and physician statistics are reviewed monthly as well."

Response 2: "Improvement in the number of cases that are deemed inappropriate"

Response 3: " We currently do not have an accurate way to measure the success of any changes implemented to improve patient blood management"

Question 6: Does your hospital require the physician to document the reason or clinical justification for transfusion in the medical record based on transfusion guidelines developed by the hospital transfusion or quality committee?

One of the three responded yes, the other two responded no.

Question 7: Does your hospital have Computerized Physician Order Entry (CPOE)?

Response 1: "Yes the physician must place orders directly into the HIS [Hospital Information System]"

Response 2: "Not currently but the hospital is currently looking into implementing one."

Response3: Stated the facility does not currently have a CPOE, but the outpatient physicians are currently using one.

Question 8. Does your CPOE include transfusion guidelines or an algorithm to assist with proper transfusion ordering?

Only respondent whose facility has a CPOE answered this question:

"Yes, the system alerts the physician when the order is outside of the guidelines."

Question 9 :**How many transfusion-related adverse reactions were reported to your transfusion service department in 2013?**

Response 1: "No hemolytic transfusion reactions were reported. There were 7 non-hemolytic reactions."

Response 2: "9 Allergic, 10 Febrile, 8 Non Specific and 2 Delayed

Response 3: "16 Allergic, 33 Febrile, 6 Non Specific and 0 Hemolytic"

Interview Questions for Pathologist at Blood Source

This set of interview questions was given one of Pathologist for SMCS's blood supplier (Appendix B). This was to get the suppliers perspective on how blood utilization should handle and to find out what they consider the advantages and disadvantages implementing a program.

Question 1: Who, if anyone, should facilities provide formal transfusion training?
Answer: There are several groups of individuals for whom a facility should provide formal training in transfusion medicine (TM)/patient blood management (PBM). The details of this training will vary based upon the role played by each of these groups.

- Physicians
  - Training in TM/PBM is particularly important for physicians who practice in those specialties that often order blood for their patients, e.g., internists, critical care physicians, oncologists, surgeons, and anesthesiologists.
  - Key training issues include:
    - Indications and dosing,
    - Risks, including transfusion-associated reactions and infections (and how to diagnose and manage such complications),
    - Compatibility testing and the use of incompatible blood products before compatibility testing can be completed in emergency situations.
- Nurses
  - Training should include basics of transfusion:
    - Indications,
    - Dosing, and
    - Risks.

- There should be special emphasis on recognition and management of adverse effects of transfusion.
- Additionally, the importance of proper identification of patients for sample collection and blood administration is key.
- Training also should pay extra emphasis on proper administration of blood products.

➢ Clinical Laboratory Scientists

- Training should include:
  - Compatibility testing criteria,
  - Recognition of adverse effects of transfusions, and
  - Transfusion Indications, and well as some basic dosing principles (i.e., to recognize orders that may be atypical and, possibly, incorrect).
- CLS's also should have basic training on administration of blood products, i.e., so that they may serve as a resource for nurses and physicians for issues such as:

The above list is not, of course, comprehensive but covers several of the major areas that formal training should emphasize.

Question 2: What transfusion guidelines would you recommend a hospital to have in place?

Answer: Transfusion guidelines need to be set based on evidence-based principles for each blood product. These will depend not just on pre-transfusion laboratory parameters but also (and often more importantly) the patient's characteristics (e.g., age, co-morbidities, and indication(s) for transfusion).

Questioned 3: Should hospitals have a blood utilization management program?

Answer: Yes. It is becoming increasingly recognized that hospitals should have a PBM program. Moreover, many accrediting agencies are starting to require a more organized and proactive approach to PBM.

Questioned 4: What are the advantages and disadvantages of a blood utilization management program?

Answer:

- Advantages
  - Proper PBM programs, which ensure that transfusions are performed only when indicated, will improve patient outcomes.
  - They also should allow for rapid intervention in the event of errors, other problematic situations (e.g., transfusion reactions), and questionable orders.
  - Additionally, fully implemented and highly functioning PBM programs will allow for monitoring of error and adverse event rates to ensure problematic trends do not progress unrecognized and un-checked.
  - A well run blood management program also will reduce costs/use of resources by minimizing unnecessary transfusions and associated adverse events.

- Disadvantages
  - These are few and include a considerable dedication of resources and authority to monitor transfusion practices and implement changes in practice when and where necessary.
  - It often may seem difficult to justify initial cost and resource allocation in this arena because PBM does not generate income (and, therefore, the cost-versus-

benefit-related advantages are not recognized until the program is fully functional).

- Often times, a strong program requires sophisticated software to identify, rapidly and accurately, questionable orders, thereby allowing for rapid provision of feedback to the ordering provider (i.e., before s/he no longer can recall the order and patient case details). This costs money and may at first be labor-intensive.
- Traditionally, physicians have not been accustomed to their orders being questioned, nor to their being required to change their practices regarding use of transfusions.
- Medicine is advancing rapidly and physicians are required to spend significant time keeping up with their own specialty-specific literature; thus, they often do not place sufficient emphasis on TM/PBM practices.

Interview Questions for Regional Laboratory Director

Since the Regional Laboratory Director is instrumental in making the decision to implement a blood utilization program, I wanted to get the Regional perspective regarding SMCS possibly implementing a blood utilization program and what kind of benefits would SMCS be looking to receive (Appendix C). The interview questions were sent to the Regional Laboratory Director. Instead of directly answering the question the researcher was sent documentation which was beneficial in answering most of the questions, but may not have had the same insight from getting the information directly from the Regional Laboratory Director. In addition the documents sent are considered confidential and proprietary, so the researcher used the documents to answer the questions while maintaining confidentiality. The researcher

recognizes that personal bias may enter into extracting the answers and will take that into consideration when completing the significant findings.

Question 1: Why is Sutter Medical Center looking to implementing a blood utilization program?

- To contain and reduce cost.
- To be better aligned with the regulatory statutes regarding blood utilization

Question 2: Currently at Sutter Medical Center is there a formal transfusion training program in place for physicians?

There is no formal transfusion training program but the hope is if a PBM program is implemented that part of the program would include education SMCS – with an emphasis on establishing physician, nurse, and laboratorian "champions" who would spread the word about the importance of following best PBM practices, and to distribute robust, PBM-related educational tools to all healthcare professionals who might benefit from them.

Question 3: What cost savings, if any, is SMCS expecting to see by implementing a blood utilization management program?

Initial cost saving would be limited if a true PMB program was implemented due to startup cost and the continuing cost of collecting data. The estimated reduction for the cost of blood products once the program is put in place is approximately $180,000 a year. This cost is for the blood components only and does not include additional cost associated with blood components such as additional processing and testing which by implementing a blood utilization program could further reduce the overall amount spent each year on blood components.

Question 4: What percentage reduction in blood component usage would make the blood utilization management program considered successful?

No information was given on this subject.

Key Interview Findings

While the interview questions were asked of the three groups who are involved with Transfusions Medicine, their viewpoints are from different aspects of the process. The first group of interviewees are the supervisors and leads of their department, so their viewpoint comes from the Transfusion Department; the second interview is with the Pathologist of SMCS's blood supplier who deals not only with the supply side of Transfusion but as a reference for both other physicians and the Transfusion Departments; the final interviewee is the Regional Laboratory Director of SMCS, who represents the administration viewpoint. On a side note, the Regional Laboratory Director at one time had been the Supervisor of Transfusion Service, so she is also able to look at the issue from the clinical side.

While the interview pool was extremely limited, there were some significant findings from the interviews. The first is while all the facilities have guidelines on when to transfuse; there seems to be a lack of training, outside of the Transfusion Department, for healthcare providers regarding transfusion medicine and the guidelines when blood components are to be transfused. The Pathologist recommends anyone involved with the transfusion process should have some sort of formal training.

Additionally in the interviews for the facilities, none currently have a patient blood management program. They do all have some sort of chart review process either monthly for one respondent of annually for the other two, but there was no mention of what is done with the information gathered. All three respondents also said there were committees regarding blood utilization in which the focus was on blood usage and wastage but again there was no mention of what was accomplished from the committees' findings.

Only one of the three facilities currently has a Hospital Information System where the physicians put in their own orders for blood transfusions. This system also contains an algorithm for when a blood component should be transfused giving the physician real time resources for when to transfuse. The pathologist's interview also mentions in his perspective a Blood Utilization Program may need this addition of software to help "identify, rapidly and accurately, questionable orders, thereby allowing for rapid provision of feedback to the ordering provider."

From the Regional Laboratory Director's interview questions, some of the interesting findings were while cost was a factor being more "aligned with the regulatory statutes regarding blood utilization". The Pathologist also felt this was a reason for starting a blood utilization management program because "many accrediting agencies are starting to require a more organized and proactive" Blood Utilization program.

Question 9 from the supervisor and lead interview, "How many transfusion-related adverse reactions were reported to your transfusion service department in 2013?" did not give any real findings except that every hospital has adverse reactions and they monitor them. A follow up question on how many total blood components their facility transfused in 2013 would have allowed the researcher to compare the facilities with the national average from "The 2011 National Blood Collection and Utilization Survey Report" (Witaker, PhD, Barbee J; Hinkins, PhD (NORC), Susan).

Survey

An eight question survey was given to the Clinical Laboratory Scientists (CLS) who work in the transfusion department at SMCS.(Appendix D) The intent of the survey was to get a perspective on how the employees feel SMCSs does with Transfusion Medicine, the importance of a blood utilization, and the roles and responsibilities of both SMCS and the Transfusion

Department in blood management. There were twenty nine CLSs given surveys, and twenty four of those surveys were returned.

Question 1: How often do healthcare providers at SMCS follow guidelines for transfusing their stable patients when the patient's lab values are as follows: < 8g HGB before transfusing RBCs, INR > 1.6 before transfusing FFP, and Platelet count < 50x103 per µl?

a. Never b. Rarely c Sometimes d. Very Often e. Always

The majority 11 out of 24 of the respondents felt the healthcare providers "Very Often" or "Sometimes" transfused the patients with in the guidelines. 2 felt they rarely followed the guidelines and zero participants felt healthcare providers Always or Never followed the recommended guidelines. (Figure 16)

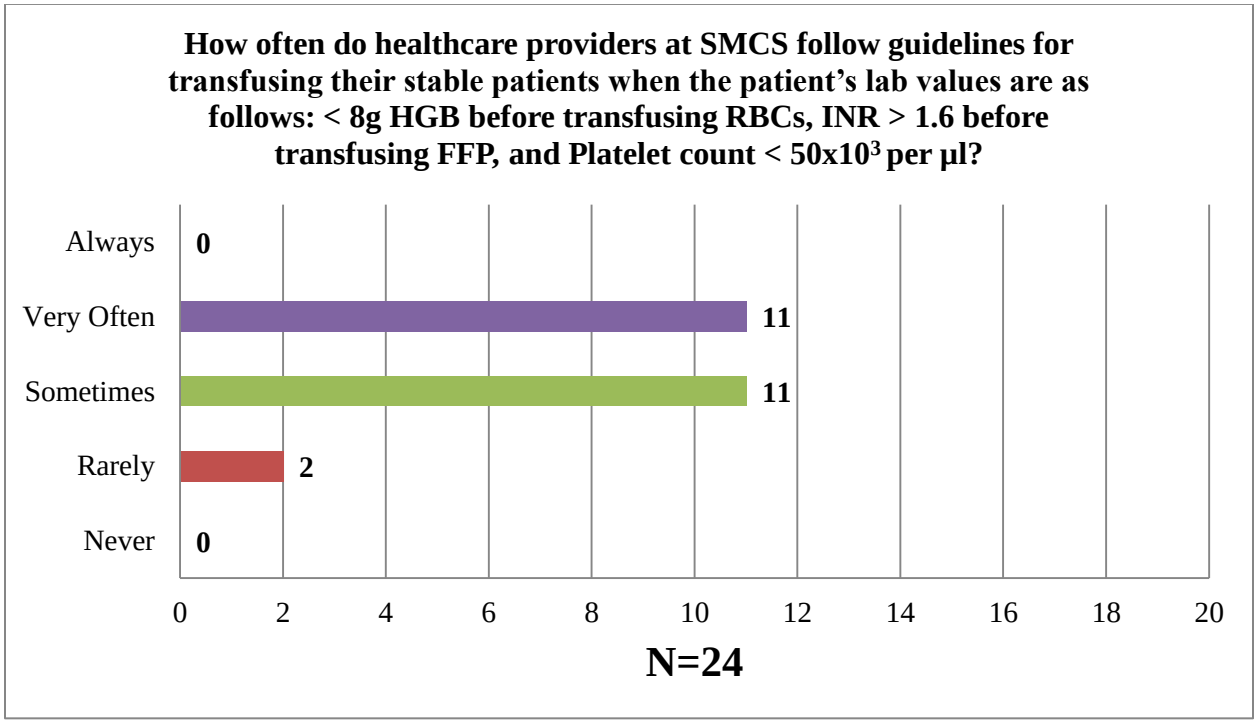


Figure 16

Question 2: In general, what level of risk for adverse reaction due to transfusions is associated with receiving blood components?

a. No Risk b. Moderate Risk c. High Risk

The majority of the respondents 22 out of 24 believe there is “Moderate Risk” for receiving a transfusion. Two felt there was a “High Risk” while zero of those who participated believe there is no risk associated with receiving a blood transfusion. (Figure 17)

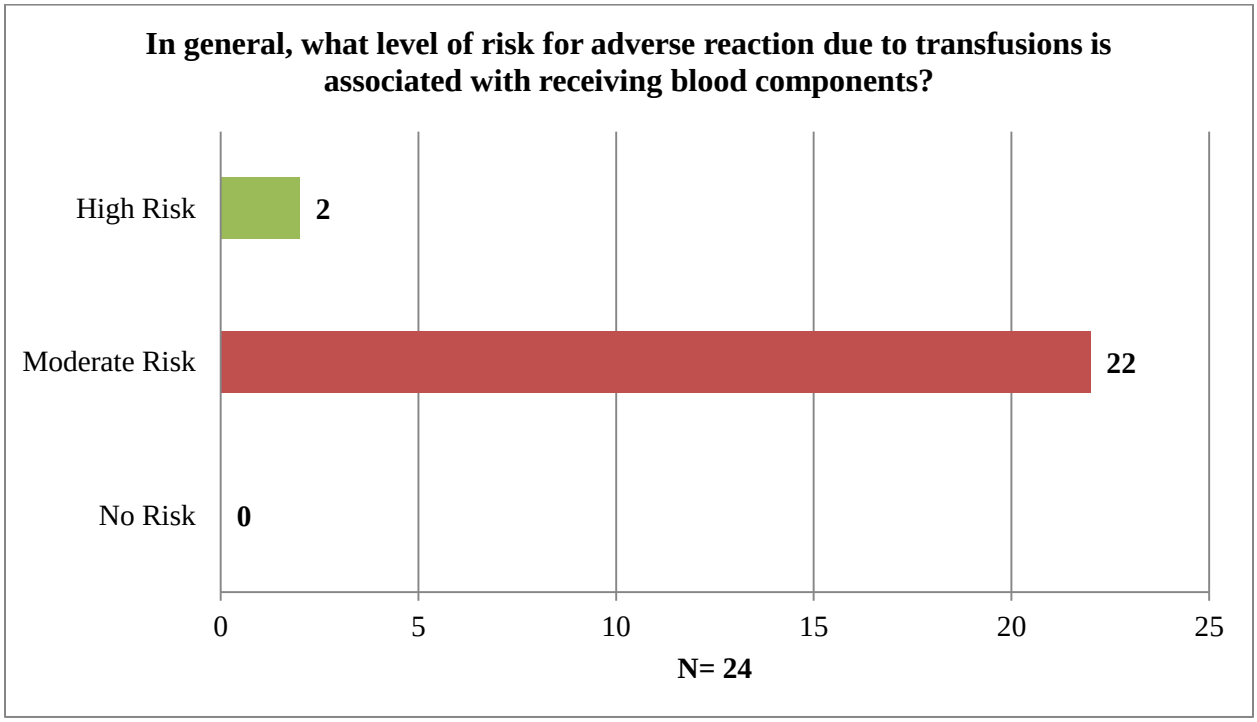
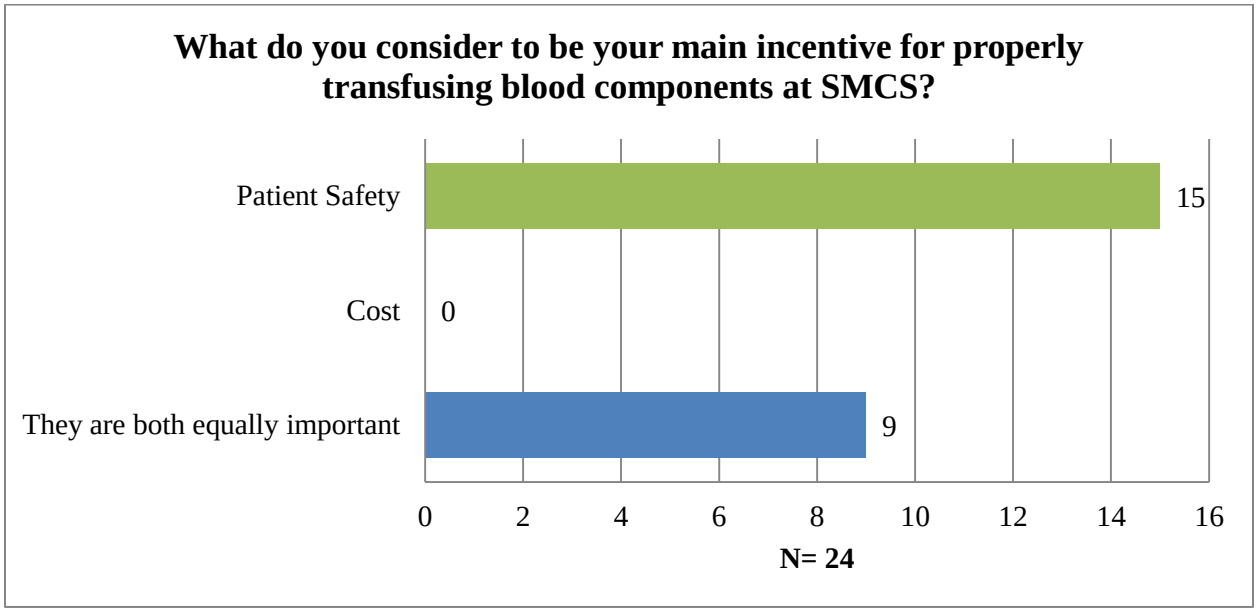


Figure 17

Question 3: What do you consider to be your main incentive for properly transfusing blood components at SMCS?

a. Patient Safety b. Cost c. They are both equally important

Out of the twenty four respondents 15 felt “Patient Safety” as a main incentive for properly transfusing blood components while 9 felt both “Patient and Cost” was a main incentive. None of the participants felt that strictly cost was an incentive for properly transfusing blood components.



Question 4: What do you consider to be SMCS's main incentive for properly transfusing blood components at SMCS?

a. Patient Safety b. Cost c. They are both equally important

For this question a majority of the participants believe the main incentive for SMCS to properly transfuse blood was both cost and safety 18 and strictly patient safety were 6. Zero of the participants felt SMCS main incentive of properly transfusing blood was Zero. (Figure

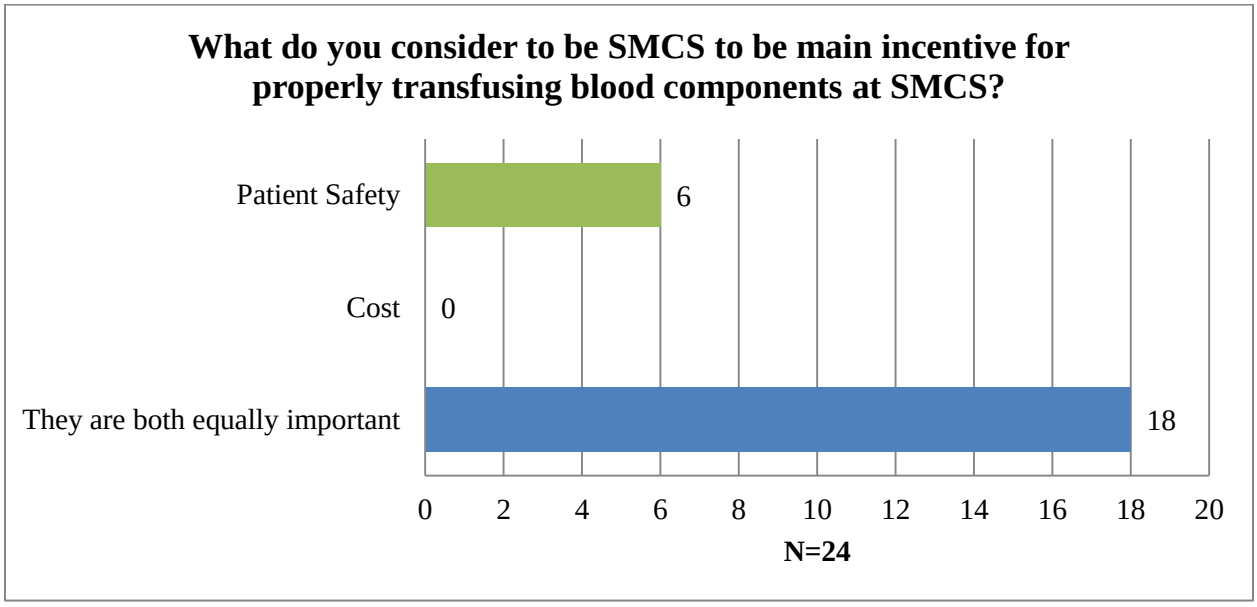


Figure 18

Question 5: How important is SMCS's responsibility to help manage the community's blood supply?

a. Unimportant b. Important c. Very Important

The majority 19 out of 24 felt it was "Very Important" for SMCS to take responsibility at helping manage the community's blood supply. 5 felt it was "Important" and Zero felt it was not Unimportant for SMCS to take responsibility helping to manage the community's blood supply. (Figure 19)

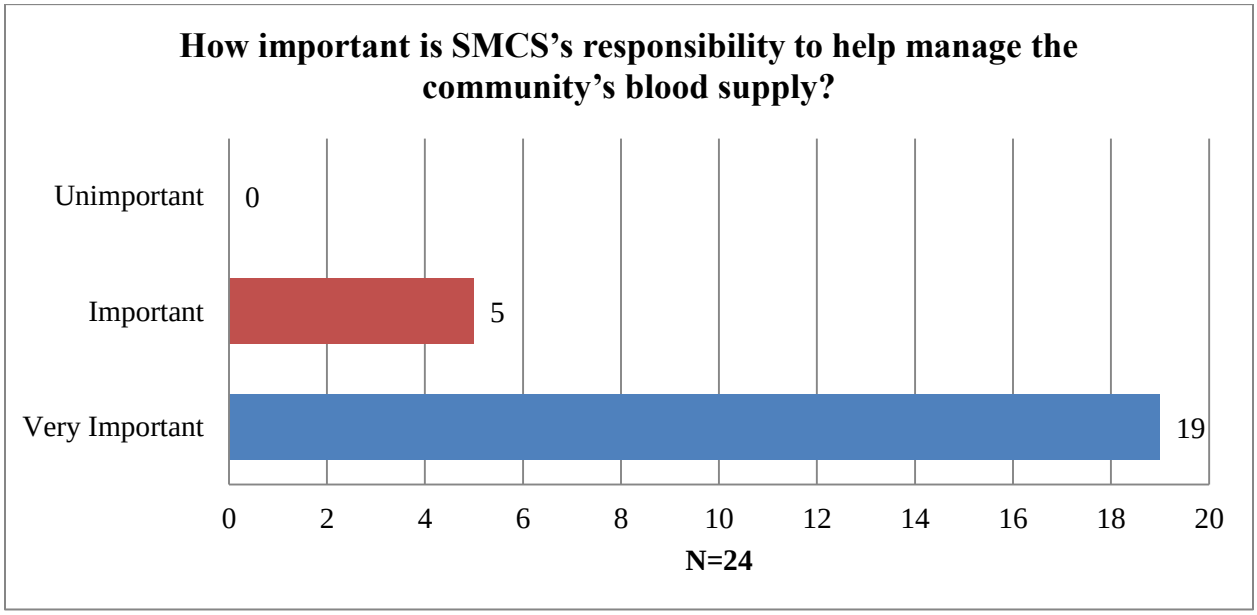


Figure 19

Question 6: How often do SMCS's healthcare providers transfuse blood components only when medically necessary?

a. Never b. Rarely c Sometimes d. Very Often e. Always

For this survey question the half of the respondents 12 out of 24 felt SMCS's healthcare providers only "Sometimes" transfused blood components when medically necessary. The other 12 respondents either felt blood components were "Very Often" 8 or Always 4 transfused when medically necessary. None of the participants felt healthcare providers "Never" or "Rarely" transfused only when medically necessary.(Figure 20)

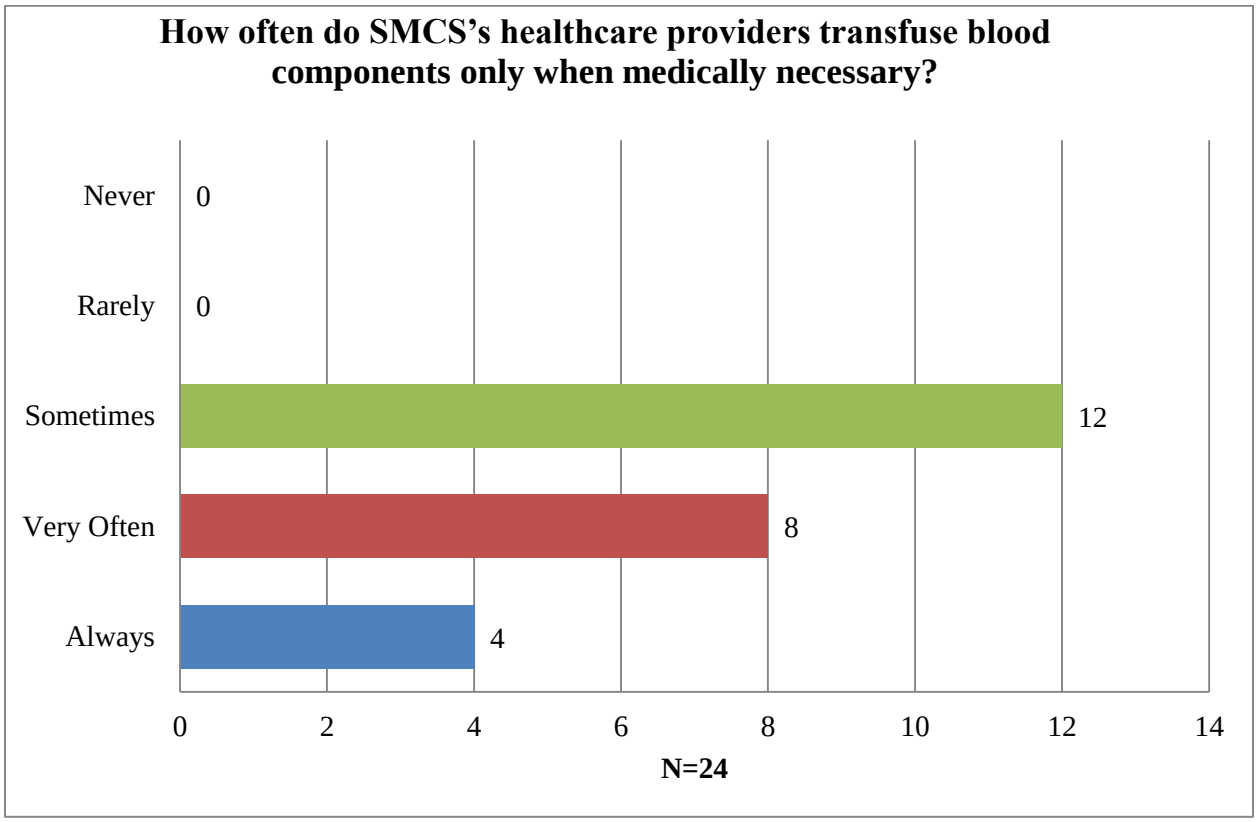


Figure 20

Question 7: Monitoring healthcare providers at SMCS is needed to ensure the appropriateness of transfusing blood components

a. Strongly Agree b. Agree c Disagree d. Strongly Disagree e. Don't Know

The majority of the respondents “Agree” 12 or “Strongly Agree” 11 that SMCS needs to monitor the healthcare providers at SMCS transfusion practices. There was one outlier who “Strongly Disagreed”. (Figure 21)

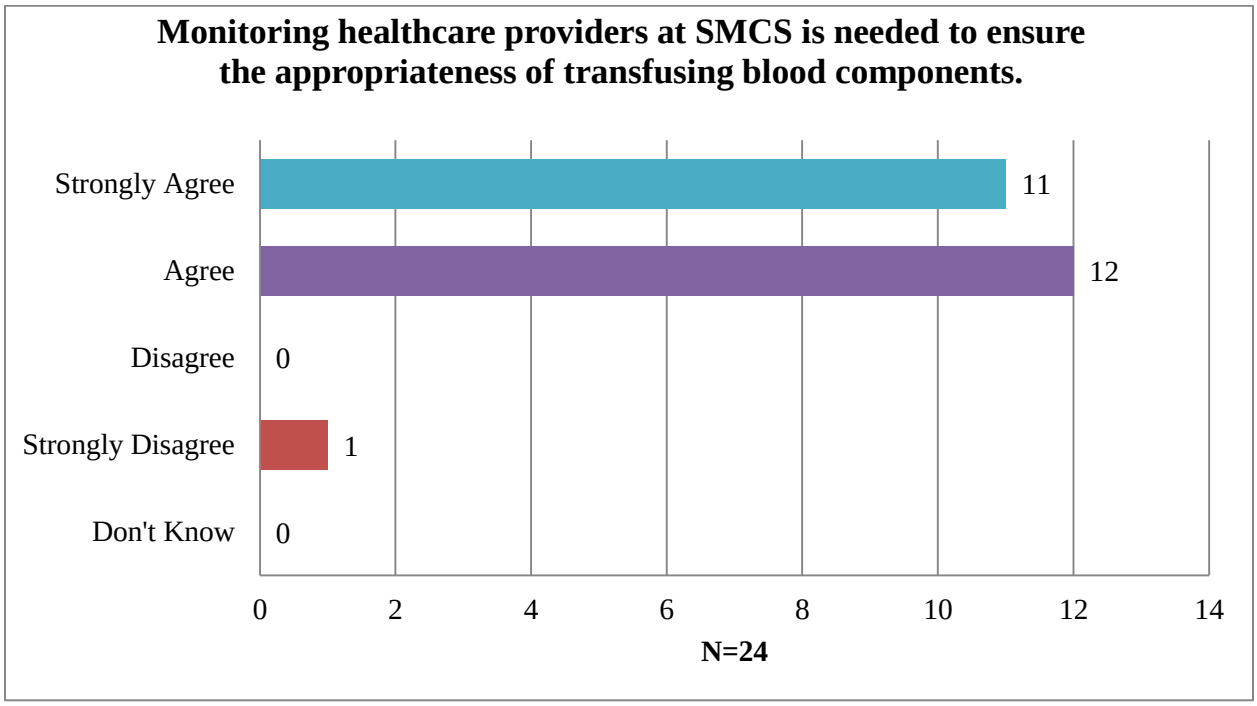


Figure 21

Question 8: When should ordering SMCS healthcare providers receive training on current standards of appropriateness for blood components transfusion? (If applicable mark more than one)

a. During initial training b. Monthly c. Annually d. When changes occur e. No training needed

For this question the participants were able to mark more than one answer. 20 out of 24 believe healthcare providers need to receive training "Annually", 9 feel training should happen during initial training and 11 feel training should occur when changes occur. None of the respondent felt there was a need for "Monthly" training or for no training to occur. (Figure 22)

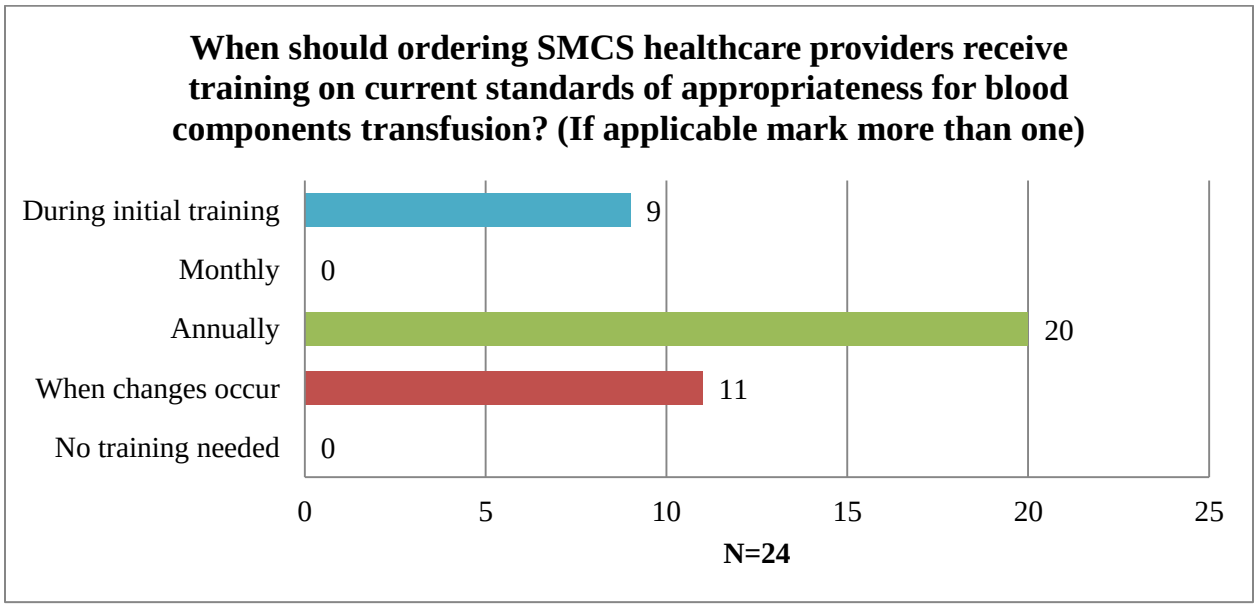


Figure 22

Key Survey Finding

These survey questions were centered on the four themes from the literature review: Cost, Supply, Risk and Transfusion Triggers. The key findings from the surveys were there were no surprises from the responses.

Cost/Risk:

Questions 3 and 4 centered around cost and risk and about how the staff perceived both their personal incentive and the SMCS incentive for properly transfusing blood components at SMCS. In their opinion neither were incentivized by cost alone, but while some felt both cost and safety were important, a majority felt the staff was more incentivized by safety and SMCS was more incentivized by both cost and safety.

Supply:

Question 5 was about the perception of how much ownership the staff felt SMCS should take in regards to the community's blood supply. The majority felt it was very important, and the others perceived it as important. No one felt SMCS should not be responsible for helping to manage the community's blood supply.

Risk:

Question 2 was asked to get the perception regarding level of risk associated with receiving blood components. No one assumed there was no risk associated with receiving blood components. A majority felt there were moderate risks and a few considered the risk to be high.

Transfusion Triggers

Questions 1 and 6 were used to get the perception on the transfusion practices of the healthcare providers. Both questioned were fairly evenly divided between very often and sometimes with regards to how the staff perceived often healthcare providers transfused within the lab value guidelines and transfused patients only when medically necessary. There were two conflicting viewpoints between the two questions. First in question one regarding how often healthcare providers transfuse within the lab value guidelines two respondents' said rarely. On question six, four of the staff members answered they felt healthcare providers always transfused when medically necessary. This disparity could be caused by several factors: how the question

was asked, the perception of the guidelines for transfusions, and what is considered medically necessary.

Part of a blood utilization program is to not only have guidelines in place, but the program is strongly centered on monitoring and training healthcare providers.

Question 7 is looking at the perspective need for a monitoring system. The split of responses was fairly even between Strongly Agree and Agree, but there was one outlier who Strongly Disagreed. Since this was a confidential survey, there was no away to go back to find out the rationale behind their answer.

Question 8 the staff could pick more than one answer about when they felt training regarding transfusion medicine needed to occur. Twenty out of the twenty-four agreed it needed to be done annually while some felt training needed to happen either initially and when changes occur.

Chapter- 5 Conclusion and Recommendations

Conclusion

The purpose of this study was to determine if there is a need to put in place a Blood Utilization Program which would monitor and educate healthcare providers on the appropriateness of transfusing blood components at Sutter Medical Center, Sacramento (SMCS). The hypothesis of this study is that in order to reduce cost, Sutter Medical Center, Sacramento (SMCS) is justified in implementing a blood utilization program since the healthcare providers are not currently following a defined transfusion policy to determine appropriateness prior to transfusing a patient.

The quantitative data obtained from the audit, the interview questions given to the Regional Laboratory Director, and the literature review supports the main hypothesis. The quantitative data indicates the possibility of physicians not following the prescribed transfusion policy since out of the 725 units audited, 292 or 40% of the units were considered outliers due to the pre-transfusion lab value. In addition, the information given by Regional Laboratory Director gives did not give the percentage of reductions in blood component usage that make the blood utilization management program considered successful but did give the figure of $180,000 SMCS is looking to save by implementing the program. The audit had the potential cost of over transfusing of patient during the three month period was $74,892, and since the number of outliers seemed fairly consent over the three months, there could end up being a $224,676 cost due to transfusing patient when it is not medically necessary.

While stated before, laboratory values are not the only factor when determining if blood was given appropriately but studies with Blood Management Programs found from overuse of blood products to be 4% (Hoeltge, MD, et al., 1999) to 24% (Thomas, Farmer, Hofmann, Isbister, & Shander, 2009). The assumption for support for the hypothesis that there are enough physicians transfusing outside of the recommend guidelines then could be made that if for a random 725 units 40% fall outside of the recommended laboratory value guidelines, at least be 4% of those are being transfused unnecessarily. During the three month period, 5000 units totaled were transfused which would leave 200 blood components transfused outside of the defined transfusion policy to determine appropriateness.

In addition, the surveys regarding how the healthcare providers were perceived regarding their transfusion practices by the Clinical Lab Scientist really did not support the hypothesis one way or another. Questions 1 and 6 regarding transfusion practices of the healthcare providers

were fairly evenly divided between very often and sometimes; Questions 1 and 6 were used to get the perception on the transfusion practices of the healthcare providers, and there were the two conflicting viewpoints between the two questions.

The cost savings portion of the hypothesis is not as supported. It is true if there were less blood products used, the amount spent on blood components would be reduced but, based on the interview questions with the Regional Laboratory Director and the Pathologist from SMCSs blood supplier, to start a Blood Management program will cost money and "until the program is fully implemented, the cost-versus-benefit-related advantages are not recognized until the program is fully functional" (Interview Questions for Pathologist at Blood Source).

Two of the main cost generating areas for a blood utilization program would be in collecting of the data for the audit and implementing an education program. As stated previously in the Methodology chapter, the original plan for data collection for the audit was to review the full three months of transfusion units. Because currently it is a manual process, it is very time consuming and would take approximately forty three hours to complete. There are Hospital Information Systems and different software which can gather the data much more efficiently; one of the hospitals whose Supervisor/Lead was interview was one which they use to extract data on a monthly basis. The Pathologist from Blood Source also mentioned in the question the disadvantages of Blood Utilization Program is that it has a strong program which requires "sophisticated software to identify, rapidly and accurately, questionable orders, thereby allowing for rapid provision of feedback to the ordering provider." This software would cost money, so it may become a barrier to implementation.

Education and training would be second and would continue generating cost since new staff members are always being brought on at SMCS. In the literature, the consensus for the

reason healthcare providers currently may not transfuse blood components appropriately is the lack of education around Transfusion Medicine (Rock, Berger, Pinkerton, & Fernandes, 2002; Arinsburg, Skerrett, & Friedman, 2012; (IOM), 2010). In the interviews, none of the facilities has an education program outside of the Transfusion Department. This is not unusual according to the results of the "The 2011 National Blood Collection and Utilization Survey Report" which states that only 23% of hospitals without some kind of patient blood management program had some kind of formal training around Transfusion Medicine. The Blood Source Pathologist's recommendation is in order to have a strong program, everyone who is involved with a transfusion should have extensive education and training. This would not only be the Transfusion staff but would include physicians, nurses, and aids. While there was no information found regarding the cost to implement a Blood Utilization Program, the cost for training and continuing education could be significant.

In addition, it was also pointed out in the interviews that a Blood Management program "does not generate income", so once the program is fully functional and the cost savings has been achieved, other aspects besides cost would need to be considered to keep the program moving forward which would be the themes brought up during the literature review supply and risks. Both the community supply and patient risks can be supported as reasons to implement a Blood Utilization Program through the literature review, interviews and the surveys.

The literature review supports the idea that blood components are in high demand but are also a limited resource (Witaker, PhD, Barbee J; Hinkins, PhD (NORC), Susan, 2011; Thomas, Farmer, Hofmann, Isbister, & Shander, 2009). In addition Proceedings from the National Summit on Overuse stated that blood components were one of the top overused products (The Joint Commission and the American Medical Association, 2012). Every time a unit of blood is

given unnecessarily, it removes a unit from the community supply for someone who may truly need it. Question 5 from the survey asks how important the Transfusion Services staff feels SMCS's responsibility is to help manage the community's blood supply. Nineteen out of the twenty four felt it was extremely important, and the other five felt it was important.

While the blood products are considered safer than ever, much of the literature supports the practice of transfusing only when absolutely necessary due to complications which can occur due to transfusions (AABB, the American Red Cross, America's Blood, 2013; Centers for Disease Control and Prevention, 2013; Elizabeth A. Katz, 2009; Goodnough, M.D. & Shander, M.D., 2012; Hebert, M.D., et al., 1999). In the interviews with the leads and supervisors, they were asked how many transfusion reactions the facility had in 2013; between the three hospitals there were ninety one transfusion reactions reported. Based on the literature, reactions are often underreported be the signs maybe misinterpreted as a part of the patient underlying issues (AABB, the American Red Cross, America's Blood, 2013; Witaker, PhD, Barbee J; Hinkins, PhD (NORC), Susan, 2011). Finally, in the survey the staff overwhelmingly chose patient's safety as the main incentive for properly transfusing blood components.

With the support of the literature, interviews, and surveys, patient safety and community supply management maybe more supported reasons to implement a program The fact the staff feels managing the community's blood supply and patient safety are considered so important to staff those factors may be a better reason than cost when it comes to justifying a need to implement a Blood Utilization program since the staff, maybe some of the leaders who will help get the program started.

Recommendations

From the results of this study, I conclude that Sutter Medical Center, Sacramento needs to approve, develop, implement, and monitor a six month pilot Blood Utilization Program. During this time, they need to analyze both the benefits and disadvantages of the program and determine if it is viable enough to implement the program permanently. In order to get this pilot underway, I have made the following recommendations.

Recommendation 1: By June 1, 2014, the SMCS Laboratory and Hospital Administration team review and approve a pilot Blood Utilization Program to include setting monthly performance goals. The results of this study, the interview with the Pathologist from Blood Source, and the information given by the Regional Laboratory Director indicate a strong need for a Blood Utilization Program, but in order to measure the success of the program, detailed and achievable performance goals need to be but in place.

Recommendation 2: By June 20, 2014, the SMC Laboratory and Hospital Administration team should develop a Blood Utilization committee made up of key stakeholders and Blood Utilization champions who would help implement and lead others to participate in the program. In his interview the Pathologist from Blood Source wrote, "Traditionally, physicians have not been accustomed to their orders being questioned, nor to their being required to change their practices regarding use of transfusions." Physicians will not be the only ones not wanting to change. A Blood Utilization Program requires a change from everyone in the transfusion process, so pushback and reluctance to change should be expected. The only way for a program like this to be successful is with strong leadership and advocates for the program. These leaders cannot just come from one department but be made up of Physicians: Multi-specialty representation, Nurses: Inpatient, outpatient, and nurse educators, Clinical Laboratory Scientist,

Pharmacists, Quality & Patient Safety Risk Managers, and most importantly Administrators both from the Laboratory & Hospital (AuBuchon, MD, FCAP, FRCP, Puca, MD, MT(ASCP)SBB, FCAP, Saxena, MD, MHA, Shulman, MD, FCAP, & Waters, MD, 2011).

Recommendation 3: Implement the Blood Utilization Pilot Program at the SMCS beginning August 1, 2014-February 28, 2015. Once the program's design and performance measures have been developed, the Administration Teams and the Blood Utilization committee need to rollout the pilot Blood Utilization Program while the passion and urgency are still felt to help make it a success.

Recommendation 4: Beginning September 1, 2014 through March 1, 2015, the SMCS Blood Utilization Committee should evaluate and report monthly performance results to the SMCS Laboratory and Hospital Administration team. The importance of monitoring this pilot program monthly is to not only celebrate the victories, but to also catch the weaknesses of the program and adjust accordingly to give it a better chance of being successful.

Research Limitations

While the study supports the purpose to determine if there is a need to put in place a Blood Utilization Program, there are limitations to the study. Only using pre-transfusion values to determine the appropriateness of a transfusion is very limiting. It only gives a very narrow picture of what is going on with the patient. All the literature suggests lab values are only the first step on why to transfuse a patient, but that it can be useful to monitor and can be good indicator a Blood Utilization Program needs to be initiated (Goodnough, M.D. & Shander, M.D., 2012; Hoeltge, MD, et al., 1999; Johns Hopkins., 2012; AABB, the American Red Cross, America's Blood, 2013)

The second limitation is there was no real comparison on how Sutter Medical Center, Sacramento currently compares on blood usage with regards to other hospitals. An attempt was made with the interview questions, but the limited numbers of interviewees and the fact the interview questions were emailed versus in person may have been a barrier to follow up questions where more information could have been gathered.

The literature review, results of the audit, and the interview and survey results have established support for SMCS to implement a Blood Utilization Program. Sutter Medical Center, Sacramento has always strived to be the front runners of change. If they want to be perceived by the community as being a leader in patient safety and as being an active participant in maintaining the communities blood supply, they may choose not to have cost be the driving force behind a Blood Utilization Program.

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Appendix A: Interview Questions for Supervisor or Leads in Transfusion Department

I am inviting you to participate in a brief interview on blood utilization management. . I am completing my master's degree in public administration at Golden Gate University. I'd like to get your personal perspectives on this topic. The interview should take you approximately 20 minutes to complete. Your answers will be kept confidential and anonymous and will be used by me for the purpose of completing my degree. I will not publicly release your responses or other information about you.
I hope that you will participate in this interview because your input is important. Thank you in advance for participating and for helping me complete my research study.

Facility:_____

1. Who, if anyone, does your facility provide formal transfusion training?

2. What transfusion guidelines does your institution use?

3. What does your patient blood management (PBM) or Blood Utilization program entail?

4. Who, if anyone, does your facility provide formal PBM training?

5. How does your hospital measure the success of interventions implemented to improve patient blood management?

6. Does your hospital require the physician to document the reason or clinical justification for transfusion in the medical record based on transfusion guidelines developed by the hospital transfusion or quality committee?

7. Does your hospital have Computerized Physician Order Entry (CPOE)?

8. Does your CPOE include transfusion guidelines or an algorithm to assist with proper transfusion ordering?

9. How many transfusion-related adverse reactions were reported to your transfusion service department in 2013?

Appendix B: Interview Questions for Pathologist at Blood Source

I am inviting you to participate in a brief interview on blood utilization management. I am completing my master's degree in public administration at Golden Gate University. I'd like to get your personal perspectives on this topic. The interview should take you approximately 20 minutes to complete. Your answers will be kept confidential and anonymous and will be used by me for the purpose of completing my degree. I will not publicly release your responses or other information about you. I hope that you will participate in this interview because your input is important. Thank you in advance for participating and for helping me complete my research study.

1. Who, if anyone, should facilities provide formal transfusion training?

2. What transfusion guidelines would you recommend a hospital to have in place?

3. Should hospitals have a blood utilization management program?

4. What are the advantages and disadvantages of a blood utilization management program?

Appendix C: Interview Questions for Regional Laboratory Director

I am inviting you to participate in a brief interview on blood utilization management. I am completing my master's degree in public administration at Golden Gate University. I'd like to get your personal perspectives on this topic. The interview should take you approximately 20 minutes to complete. Your answers will be kept confidential and anonymous and will be used by me for the purpose of completing my degree. I will not publicly release your responses or other information about you. I hope that you will participate in this interview because your input is important. Thank you in advance for participating and for helping me complete my research study.

1. Why is Sutter Medical Center looking to implementing a blood utilization program?

2. Currently at Sutter Medical Center is there a formal transfusion training program in place for physicians?

3. What cost savings, if any, is SMCS expecting to see by implementing a blood utilization management program?

4. What percentage reduction in blood component usage would make the blood utilization management program considered successful?

Appendix D: Survey Questions to SMCS Transfusion Department CLS

I am inviting you to participate in a brief survey on blood utilization management. I am completing my master's degree in public administration at Golden Gate University. I'd like to get your personal perspectives on this topic. The survey should take you approximately 5 minutes to complete. Your answers will be kept confidential and anonymous and will be used by me for the purpose of completing my degree. I will not publicly release your responses or other information about you. I hope that you will participate in this interview because your input is important. Thank you in advance for participating and for helping me complete my research study.

Please answer the following questions by circling the response which most accurately expresses your view point.

1. How often do healthcare providers at SMCS follow guidelines for transfusing their stable patients when the patient's lab values are as follows: < 8g HGB before transfusing RBCs, INR > 1.6 before transfusing FFP, and Platelet count < 50x103 per µl?

a. Never b. Rarely c Sometimes d. Very Often e. Always

2. In general, what level of risk for adverse reaction due to transfusions is associated with receiving blood components?

a. No Risk b. Moderate Risk c. High Risk

3. What do you consider to be your main incentive for properly transfusing blood components at SMCS?

a. Patient Safety b. Cost c. They are both equally important

4. What do you consider to be SMCS to be main incentive for properly transfusing blood components at SMCS?

a. Patient Safety b. Cost c. They are both equally important

5. How important is SMCS's responsibility to help manage the community's blood supply?

a. Unimportant b. Important c. Very Important

6. How often do SMCS's healthcare providers transfuse blood components only when medically necessary?

a. Never b. Rarely c Sometimes d. Very Often e. Always

7. Monitoring healthcare providers at SMCS is needed to ensure the appropriateness of transfusing blood components

a. Strongly Agree b. Agree c Disagree d. Strongly Disagree e. Don't Know

8. When should ordering SMCS healthcare providers receive training on current standards of appropriateness for blood components transfusion? (If applicable mark more than one)

a. During initial training b. Monthly c. Annually d. When changes occur e. No training needed