

**UPMC Patient Blood Management Team: Implementing Quality Improvement Initiatives  
for Better Patient Centered Care Amid a Public Health Crisis**

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# **UPMC Patient Blood Management Team: Implementing Quality Improvement Initiatives for Better Patient Centered Care Amid a Public Health Crisis**

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## **Abstract**

As the field of health care moves toward value-based care, quality plays an integral role in health systems today. The concept of quality touches every area of an integrated health delivery system. For health systems today, an individual patient's overall experience and outcome is more important than the quantity of patients seen. Due to new reimbursement strategies and the overall benefits that increased quality brings to an organization, health systems are always looking to improve the quality of care being delivered to patients. To improve the quality of care, many high-level health organizations have entities dedicated to quality improvement (QI). The University of Pittsburgh Medical Center (UPMC) has established the Wolff Center as its hub for quality improvement, patient safety, and patient satisfaction.

The Wolff Center houses many interdisciplinary teams dedicated to quality improvement within the UPMC system. One of those teams is the UPMC Patient Blood Management (PBM) team. The UPMC PBM team manages and oversees the field of transfusion medicine at UPMC hospitals. Transfusion medicine plays a critical role within UPMC hospitals and is highly significant to public health. It is imperative that best practice methods are implemented and the quality standards within transfusion medicine are continuously improving. Using quality improvement initiatives to ensure that the methods used within the field of transfusion medicine are superior at UPMC can dramatically increase the overall patient experience and make for better clinical outcomes.

This paper will highlight four quality improvement initiatives, collectively put together as an Avoidable Blood Waste Toolkit. Specifically, why these initiatives are needed in an integrated health delivery system, the ever-growing need to continue quality initiatives centered around patient blood management, and the possible outcomes and benefits that arise after the implementation of the quality initiatives.

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## **1.0 Introduction**

As a Master of Health Administration (MHA) student and resident at the UPMC Wolff Center, I have gained invaluable experience in every aspect of a quality improvement project. The Wolff Center is a key part of UPMC as the staff members' work pertains to every area of the integrated health delivery system. The work done at the Wolff Center is able to impact every UPMC entity, patient, health plan member, or employee. Because of the COVID-19 pandemic, the work done at the Wolff Center also proved to be especially important in keeping the Pittsburgh community safe and healthy. The intertwining of clinical care and administration work has ignited my passion and desire for a future career in quality improvement in a health care setting.

## **2.0 Background**

Hospitals have an obligation to maintain an adequate blood supply to properly support its patients. This means having enough blood components on hand to not delay care as this can result in longer hospital stays, increased costs, increased risks for patients and increased patient dissatisfaction (Gammon et. al, 2021). To help maintain a hospital's blood supply, it is vital that providers and hospital staff members do not waste any blood. Most hospitals in the United States have a blood component wastage rate between 1% and 5% (Hannon, 2015). Put into perspective, a 1% to 5% wastage rate of 21 million blood products in the United States amounts to 200,000 to 1 million wasted blood units at a cost of up to 230 million dollars (Hannon, 2015). Equally important is the loss of an already historic low number of donors.

Studies have shown that low-intensity and low-cost interventions can reduce the amount of avoidable blood waste within hospitals (Hannon, 2015). The University of Pittsburgh Medical Center's (UPMC) Patient Blood Management (PBM) team identified high wastage rates of blood components, especially cryoprecipitate (cryo), daily, mainly from order entry errors by providers and the blood components not being stored properly by their outlined procedures. It was clear that interventions needed to take place to provide awareness, accountability, and change providers' behaviors. In doing so, UPMC would then be able to save blood units, ultimately benefiting the hospital's bottom line, but more importantly the care delivered to its patients.

UPMC is the largest integrated health delivery system in Pennsylvania. UPMC is also recognized nationally and worldwide for its innovations and high standards of quality in health care. As a top performer in health care, it is imperative that UPMC actively uses quality

improvement initiatives to continue use of best practice methods and implement better patient centered care techniques.

One of UPMC's main business lines is emergent and elective surgeries. Undeniably, UPMC has become a national leader in organ transplant surgeries. Efforts from numerous departments have dedicated work into UPMC's surgical line of business to streamline processes and improve patient outcomes. Transfusion Medicine is just one department that has been able to positively impact UPMC surgeries and is vital to its overall success.

While transfusion medicine can be lifesaving, it should not be a provider's first option to aid a patient's status, in non-emergent situations. There are several strategies in which a physician can use to possibly avoid a blood transfusion during major surgeries. However, it is still quite likely that a patient undergoing invasive surgery will need a blood transfusion which calls for Transfusion Medicine services. Not only does Transfusion Medicine aid patients undergoing surgery, but UPMC also cares for thousands of critically ill patients a year, many of which will need blood transfusions for many different reasons and treatments. Transfusion medicine plays a critical role within UPMC hospitals and can be truly lifesaving for those patients in need.

This paper will focus mainly on how UPMC manages its transfusion medicine services and the uses of quality improvement initiatives to identify opportunities of improvement, increase efficiency within a hospital, and overall provide better care for a patient in an inpatient setting.

### **3.0 Transfusion Medicine**

Transfusion medicine is the area of medicine that pertains to all aspects of blood and its components (*Transfusion Medicine*). The blood components of focus within this paper will be cryoprecipitate (cryo), fresh frozen plasma (FFP), platelets, and red blood cells (RBCs). Transfusion medicine hosts a variety of subcategories such as blood donation, clinical laboratory testing, and patient blood management, which all present vital aspects to the overall process of transfusion medicine.

#### **3.1 Transfusion Medicine Process**

Instead of a single event, transfusion medicine is a process which requires a chain of sequential events involving many health care professionals and stakeholders (*Transfusion medicine*). It starts with a possible donor and finishes with a clinical outcome for a patient. It is imperative that each step of the process is done accurately by trained and licensed professionals to ensure the safety of the donor and patient.

The process begins when a considered donor is approved for donorship by preliminary health history questions and point of care testing including hemoglobin level. Once approved, nurses at a donation center can then safely collect blood from the donor. When the blood is collected, blood handlers must test the collected specimen for disease, compatibility, and perform any other special modifications that may need to be done in a laboratory setting. After testing, the collected blood specimen is then deemed ready for use and is kept in proper storage conditions.

Before donated blood can be transfused into a patient, several health care providers must confirm that a patient is a match for the blood product and that it is in fact needed. After the transfusion, evaluations of how the patient responds to the blood product are also needed as a follow up. The end goal of the transfusion process is to give the correct blood product to a matching patient in need and have a successful clinical outcome.

### **3.2 Patients Eligible for Transfusion Medicine**

Studies reveal that about one in seven people entering a hospital will need blood (*Blood Facts*). Patients who have undergone serious trauma or burns resulting in severe blood loss are going to benefit from a blood transfusion. Mentioned previously, patients at risk for losing a large amount of blood due to major surgeries will most likely benefit from a blood transfusion as well. Many specific medical conditions such as sickle cell disease, numerous types of cancers, and hemophilia will also require patients to receive blood transfusions. Critically ill patients also have a high prevalence of anemia, which often results in the need for consistent blood transfusions. It is clear that a diverse inpatient patient population within a hospital shows a great need for transfusion medicine and all of its subcategories.

## **4.0 Patient Blood Management**

Patient Blood Management (PBM) is a multidisciplinary, evidence-based approach to optimizing the care of patients who need a blood transfusion (*Patient blood management*). It encompasses all aspects of patient evaluation and clinical management decision-making surrounding the transfusion process. PBM supports and implements best practice methods outlined by the World Health Organization to change the focus of transfusion medicine on patients, rather than the blood products.

### **4.1 Patient Blood Management Teams**

A PBM team is composed of a variety of leadership members who are involved in different areas of the transfusion process. The people on a PBM team can be unique to every hospital but often include policy makers, physicians, anesthesiologists, blood bank managers, quality improvement specialists, and any other health care professionals who would be involved in transfusion medicine. Together the PBM team works toward a common goal of developing a plan using pharmaceuticals, technology, and other techniques to reduce patient blood loss and enhance blood cell production (*Patient blood*).

## **4.2 UPMC Patient Blood Management Team**

The University of Pittsburgh Medical Center (UPMC) has put together a group of experts in the field of transfusion medicine to form their own PBM team. The current Medical Director is Dr. Jonathan Waters, MD. The Medical Co-directors are Dr. Louis Alarcon, MD, and Dr. Darrell Triulzi, MD (*UPMC Blood*). Mary Kay Wisniewski is the Director and Senior Quality Improvement Specialist (*UPMC Blood*). Deborah Tatro is the Bloodless Medicine Advocate (*UPMC Blood*). UPMC's PBM team has had great success in blood conservation, associated blood cost reductions, and reducing unnecessary blood transfusions in all UPMC hospitals.

While these five individuals make up the core of UPMC's PBM team, many other health care professionals are often involved in sharing their expertise. Depending on what the PBM team is working on, blood bank managers, laboratory managers, nurses, administrators, and anesthesiologists could all play a critical role in helping the PBM team complete a project. Many of these health care professionals also join PBM meetings regularly to stay informed and share ideas. Regardless of who is involved, the UPMC PBM team and supporting personnel is determined in improving patient care by implementing better blood management techniques.

## **4.3 Patient Blood Management Teams Benefits**

PBM teams provide hospitals with numerous benefits that impact cost savings and patient outcomes. PBM teams save hospitals hundreds of thousands of dollars annually by helping to conserve a hospital's blood supply. With the cost of blood continuously rising and overall lack of

donorship, PBM teams are able to enable best practice methods to conserve a hospital's blood supply with minimal waste.

PBM teams play a key role for hospitals with successful patient outcomes. Countless global studies have found that patients who have undergone surgeries supervised by a PBM team have had significantly better clinical outcomes than those patients without a PBM team's support (Franchini et. al, 2019). PBM teams ensure that a patient will receive the correct amount of blood only when needed and mitigate the risk of a patient going through unnecessary blood transfusions (Franchini et. al, 2019). PBM teams have a direct impact on the quality of care provided during a patient's hospital visit and can gain more reimbursements for a hospital.

Innovations in practice and technology give the experts who are on a PBM team limitless boundaries to how they can improve transfusion medicine. With a team dedicated to improving and managing transfusion services, every hospital could benefit in having a PBM team. PBM teams will continue to collaborate and implement best practices to deliver better patient centered care, ultimately benefiting all stakeholders involved in the transfusion process.



## **5.0 The United States' Market for Blood**

The United States uses a free-market approach to maintain its blood supply (Allen, 2019). The Red Cross supplies 40 percent of the nation's blood, but the other 60 percent comes from other blood suppliers (Allen, 2019). The different blood suppliers compete with one another for a hospital's business. Hospitals may have one or multiple blood bank suppliers depending on their strategic business approach. Together, a hospital and a blood bank supplier have a symbiotic relationship in order to deliver patient care.

### **5.1 Blood Supply**

The nation's blood supply can only come from donors. Since blood is not yet able to be manufactured in a lab, it is a major public health responsibility to encourage the population to donate. Eligible donors can donate all components of blood including whole blood, red blood cells, plasma, and platelets. One blood donation has the power to save up to three lives. People who are able to donate blood can donate about six times a year, which could save 24 lives. However, statistics reveal that less than 38 percent of the population is eligible to donate and only 3 percent of age-eligible people donate yearly (Allen, 2019). The Red Cross States that a blood transfusion is needed every two seconds (*US Blood Supply*). With such a high demand for blood, it is difficult for hospitals and health systems to keep enough blood supply on hand for the patients who really need it.

## 5.2 Blood Shortage

The nation's blood supply is at serious risk for a critical shortage due to lack of donorship and the COVID-19 pandemic. Prior to the pandemic, it has been found that Generation Z is just not as willing or likely to donate blood as much as older generations (*US Blood supply*). In Pennsylvania, blood donorship is down 50 percent since the youngest age-eligible generation collectively is not donating enough to keep up with demands.

The COVID-19 pandemic has also presented many obstacles in achieving a sufficient blood supply to hospitals. Many locations where blood drives are held such as universities, churches, and community centers have been closed. Due to social distancing restrictions, over 2,700 blood drives have been canceled resulting in 86,000 fewer donations (As of March 2020) (Brady, 2020). Instead of five days' worth of inventory, the pandemic has decreased the national blood supply down to one and a half days (*US Blood supply*).

A blood shortage creates several challenges for hospitals. Not only does blood have to be carefully allocated to those patients most in need, but the cost of the blood itself can be more expensive. Shipping blood out of state increases the prices of blood components immensely and takes longer for the hospital to receive it. Altogether a blood supply shortage negatively impacts hospitals and patients in need of blood transfusions which has been highlighted due to the COVID-19 pandemic.

## **6.0 Blood Waste**

Blood products become unusable if they are not kept in their proper outlined storage conditions or if they are not used within their specified time frame. The different components of blood have different storage guidelines and procedures. Unfortunately, there are an infinite number of events that could occur for the blood products to not be stored properly. For the benefit of the hospital, provider, and patient, it is crucial that the hospital's blood supply is not wasted. However, sometimes events occur that are inevitable and out of the provider's control that lead to blood waste. Other times waste occurs due to errors that could have been controlled and altogether avoided. These different types of events create two categories of blood waste: non-avoidable blood waste and avoidable blood waste.

### **6.1 Non-avoidable Blood Waste**

There are not many instances of non-avoidable blood waste, but sometimes extreme events do occur. Non-avoidable blood waste goes beyond a provider's mistake. It occurs when all protocols are followed but still for some reason blood ends up being wasted. An example of non-avoidable blood waste could be if a patient died before a unit of blood was transfused and for some reason the unit of blood could not be brought back to the blood bank in its proper conditions and therefore expired. At quaternary trauma hospitals, such as UPMC Presbyterian, unprecedented events may happen. It is rare, but there are times in which providers follow all necessary procedures in the transfusion process, but still end up wasting blood.

## **6.2 Avoidable Blood Waste**

Avoidable blood waste occurs more frequently than non-avoidable blood waste, unfortunately. Avoidable blood waste mainly occurs from providers not following outlined protocols, lack of provider awareness, or because of transportation issues. For the sake of this paper, the main categories of avoidable blood waste will be due to blood products not kept at proper temperatures, blood products expiring before transfusion, providers ordering the incorrect amount of blood for a patient, and because of transportation or miscellaneous issues. While avoidable blood waste may occur quite frequently, the causes for the wasted blood can be addressed and fixed so that it does not happen in the future. With due diligence and a team of health care professionals, it is possible to diminish most, if not all, avoidable blood waste within a hospital.

## **7.0 The University of Pittsburgh Medical Center**

The University of Pittsburgh Medical Center (UPMC) is a 23 billion dollar not for profit integrated health delivery system (*By the numbers*). UPMC's mission of serving its community by providing outstanding patient care is done by offering services from hospitals, specialty service lines, behavioral health, cancer care, children's health, women's health, rehabilitation, and health insurance. UPMC's outstanding patient care has been recognized nationally and boasts accolades in almost every service line (*By the numbers*). With over 90,000 employees, UPMC continues to grow, innovate, and prove itself as a top leader in the health care sector (*By the numbers*).

### **7.1 UPMC Hospitals and Vitalant**

UPMC has 40 academic, community, and specialty hospitals with over 8,000 licensed beds (*By the numbers*). UPMC's Patient Blood Management team's work is able to impact all 40 of those hospitals. While UPMC's PBM team's work may touch all 40 UPMC hospitals, this paper will mainly focus on the UPMC hospitals that are served by Vitalant. Vitalant is a nonprofit blood bank organization that serves about 900 hospitals across the United States (*Hospital Services*). Most of UPMC's hospitals are served solely by Vitalant including Presbyterian, Montefiore, Shadyside, Mercy, Magee Women's Hospital, Children's Hospital, Horizon, East, Passavant, McKeesport, and St. Margaret. UPMC is unique in that it is one out of only two hospitals in the United States that hires an exclusive blood banking staff.

## 7.2 UPMC Vitalant-Served Patient Population

Collectively, UPMC has 382,000 inpatient admissions and observation cases, 1.1 million emergency visits, and 256,000 surgeries every year (*By the numbers*). UPMC is one of the most comprehensive trauma systems in the nation. Over 11,000 adult trauma patients and 1,700 pediatric trauma cases are seen annually (*UPMC Trauma*). Also, as a leader in transplant surgeries, UPMC has performed over 20,000 organ transplant procedures since 1981 (*About UPMC Transplant*). In April 2020, UPMC had a record high of lung transplants due to the COVID-19 pandemic (*About UPMC Transplant*). UPMC Presbyterian has 150 critical care beds and is known for taking care of patients with complex cases (*By the numbers*). With a high trauma, surgical, and critically ill patient population, it is clear that UPMC's PBM team plays an integral part in UPMC's clinical success as many of these patients require transfusion medicine.

## **8.0 Quality in an Integrated Health Delivery System**

Quality plays a major role within an integrated health delivery system. Not only does quality matter when providing better patient care, but it also determines how much financial reimbursement the institution will receive from insurance and government funded programs. It is imperative for a globally recognized health organization, such as UPMC, to maintain and improve their standard of quality throughout the entire health system. By continuously improving the quality of care being delivered, UPMC is able to gain more market share, receive higher reimbursement rates, and improve the entire patient experience. It takes a tremendous amount of effort and thoughtful systematic processes just to improve one area of such a large integrated health delivery system. As an organization, UPMC has realized the need and value for quality improvement and has dedicated an entire entity to improving all aspects of the integrated health delivery system.

### **8.1 Quality Improvement Defined**

In health care, Quality Improvement (QI) is defined as the framework used to systematically improve the way that health care is delivered to patients (*Approaches to Quality*). QI focuses on improving processes by measuring, analyzing, and controlling the ways in which providers deliver care. The main goal of QI is not to eliminate errors completely, but to learn from mistakes and use errors as an opportunity for improvement. QI aims to create stable and predictable processes to reduce process variation and improve outcomes for both the patient and the

organization (*Approaches to Quality*). It takes a great amount of teamwork and continuous effort from all stakeholders involved to achieve a successful, sustainable quality improvement project.

## **8.2 Structure of a Quality Improvement Project**

While there are no limits as to the subject matter for QI projects, every QI project uses a similar core structure. All QI projects should:

1. Define the project goal.
2. Measure the current level of performance.
3. Analyze the cause of current issues.
4. Identify how the process can be improved.
5. Develop mechanisms or techniques for controlling the improved processes for sustainability over time.
6. Create measurables to determine the success or improvement rate of the project.

*(The define, measure)*

Extra steps for governance or approval by different stakeholders may be added to the QI project structure, but every QI project should at least meet the above listed steps in order to have a successful outcome.



### **8.3 Benefits of Quality Improvement**

QI projects are able to provide numerous types of benefits for an integrated health delivery system, posing little risk to those involved. Not only are QI projects beneficial, but sometimes are deemed necessary by governing bodies, such as the Joint Commission in order for the health organization to stay running effectively. A single QI project often creates multi-faceted benefits for all areas of an integrated health delivery system.

Perhaps the most important benefit of QI projects and the goal of many is that they are able to produce better patient care. The majority of QI projects are focused on improving processes with the patient at the center of attention since that is the direction that modern healthcare is moving toward. Improving patient-centered care holds tremendous benefits of its own to the health organization but doing so all starts with QI projects.

Another benefit of QI projects is that they streamline processes, ridding the organization of waste and improving efficiencies. It is known that delivering health care often results in unnecessary processes that could be harmful to the patient or provider. QI projects have the power to focus in on a process and streamline it so that it is as effective and efficient as possible. Not only will this serve the organization good by reducing waste but also reduces the possible risk to both the patient and provider.

QI projects are beneficial to organizations because they can be one of the best ways to reduce costs within an integrated health delivery system. QI projects can be budget neutral as successful outcomes are able to avoid costs associated with process failures and poor outcomes. It is much easier for an organization to maintain reliable streamlined processes and reduce costs while doing so.

Last but not least, QI projects create a safer environment within the health system. Since QI is based on a systematic approach, best practice methods are used to optimize patient care. Safeguards are often created in the process so that unsafe events are less likely to occur. QI is intended to create a safer, more transparent culture focused on quality.

#### **8.4 UPMC Wolff Center**

UPMC has recognized how vital QI is to the organization and established its own entity, the Wolff Center, dedicated to QI, patient safety, patient satisfaction, and innovation (*About Us*). The Wolff Center partners with UPMC leadership, hospitals, physicians, and departments to improve the way in which UPMC delivers care. By establishing high standards of quality, best practice methods, and implementing new technology, the Wolff Center ensures that UPMC is putting the patients' needs first. The Wolff Center even offers ongoing educational programming focused on the improvement of delivering care. With quality as a top priority, hard work and dedication, the Wolff Center is committed to improving patient care throughout the entire UPMC system.

#### **8.5 UPMC QI Governance**

At the Wolff Center, many diverse QI projects take place and the way they get finalized requires different stakeholders and approval points. Overseeing the entire Wolff Center's work is

Chief Quality Officer, Tami Minnier. Ultimately, every project must be approved by her before it is put into action.

UPMC's PBM team and its initiatives requires the buy-in from many other stakeholders as it is a multidisciplinary field. Regarding the specific QI project of the Avoidable Blood Waste Toolkit, it was crucial to get the approval from Dr. Triulzi and Dr. Waters because they would be the leadership putting it into practice for physicians. It was equally important to get the approval from Adiah Thomas, Vitalant Blood Bank manager, because she would be the leadership in charge of her staff controlling blood bank workflow. Several other stakeholders such as Chief Nurse Officer (CNO) groups and anesthesiologists provided great feedback and led the QI project in a productive direction. All stakeholders involved in UPMC's PBM team's QI projects must be on the same page in order for it to be successful. After getting the approval from the necessary stakeholders involved, every project also needs to be approved by Tami Minnier where she has the final say.

## **9.0 Avoidable Blood Waste Toolkit**

The UPMC PBM team's QI project of focus for this paper revolves around the creation of an Avoidable Blood Waste Toolkit for UPMC hospitals. A QI toolkit simply refers to multiple different QI projects that all have a common goal and are put into action in a close time period. In order to reduce the amount of avoidable blood waste within UPMC hospitals, the UPMC PBM team used turnaround time and expectation fliers, timers on blood bank coolers, 2mL lavender top tubes, and quarterly dashboards as tools in the Avoidable Blood Waste Toolkit.

### **9.1 Turnaround Times and Expectations Fliers**

When providers order blood products for a patient there are requirements in which the provider needs to fulfil and multiple steps in which a blood bank staff member must perform. Since most physicians and providers are not experts in transfusion medicine, they can be unaware of the processes that the blood bank staff must perform to accomplish their requests and the required time it takes to prepare different blood products. The lack of knowledge by the providers had caused conflicts with the blood bank staff, miscommunications, and ordering errors. January 2020 root cause analysis (RCA) reports indicated that 12% of total blood units wasted at UPMC Presbyterian were due to order entry errors, the third highest leading cause of avoidable blood waste.

The UPMC PBM team noticed this problem and saw it as an opportunity to improve a process and establish a baseline. Providers ordering blood products needed a guide of what is necessary to give to the blood bank (e.g., preliminary blood work) and how much time it would

take to have their blood products ready for their patient. Simplifying a process and having information easily accessible is always important for a QI project. It was then decided to create a Turnaround Times and Expectation Flier to hang in select UPMC operating rooms and hospital blood bank rooms. Giving the providers and blood bank staff the same information allows for transparency and everyone to have the same expectations of a process.

To validate that the information was accurate on the flier required the approval from transfusion medicine physicians, Dr. Waters and Dr. Triulzi. Vitalant blood bank manager, Adiah Thomas, also played an important role when creating the fliers because she is the expert in the hospital blood bank. She provided the specific details of preparing blood products and approximately how long the different processes can take. After validating and collecting accurate information, the flier could then be designed.

The flier has an easy-to-read table of the different blood components that could possibly be ordered, what steps need to occur from the blood bank, and most importantly to providers, how long it will take for the blood product to be ready for transfusion. It also shows the difference in turnaround times of whether the patient's blood is cross matched or not. By giving providers easy access and awareness to realistic time expectations for blood products, they are able to deliver better care to their patients. The turnaround times and expectations fliers also gave providers insight as to what products would be absolutely necessary to order for their patients. For example, if a provider saw that a blood product would take an hour to thaw, and the patient needed immediate attention, the provider would not order that product, ultimately helping to conserve UPMC's blood supply. While it may seem like a simple QI project, creating this flier took a tremendous amount of thought and the approval and insight from different stakeholders. However,

the end result gave the appropriate providers the information they needed in order to increase patient-centered care at UPMC.

## **9.2 Timers on Blood Bank Coolers**

When providers order red blood cells (RBCs) and Fresh Frozen Plasma (FFP) for patients undergoing surgery, the blood bank staff prepares a cooler with the blood products inside. The cooler keeps the RBCs and FFP at their proper storage temperature, 2-6°C and 4°C, respectively. The anesthesiologist technician will then come to the blood bank to pick up the cooler with the blood products and take it back to the operating room. On the occasion where not all of the products need to be transfused, the RBCs and FFP products must be kept in the cooler and returned to the blood bank within eight hours. If this protocol is not followed, the RBCs and FFP will be deemed unusable due to inadequate storage conditions or an outdated time frame.

Incorrect storage conditions are the main causes of avoidable blood waste within the entire UPMC Vitalant-served hospital group. January and February 2020 RCA reports indicated that at least 2 units and up to 25 units of blood were being wasted daily due to incorrect storage conditions. January 2020 data revealed that 47% of UPMC Presbyterian's total avoidable blood waste occurred from blood units being deemed unusable due to incorrect storage temperatures. UPMC Presbyterian's operating rooms showed the most room for improvement as they were the location where waste was occurring daily.

At UPMC Presbyterian and Montefiore, the issue of blood bank coolers not being returned to the blood bank within the eight-hour time frame had clearly become a continuous problem. RBC and FFP units were being wasted daily due to a process that was not working or lack thereof. The

UPMC PBM team, alongside Adiah Thomas, further investigated a solution to fix a process that was leading to avoidable blood waste.

Evidence-based practice showed that many other hospitals in the country and some even in Pittsburgh, attach timers to the blood bank coolers being sent out to the operating rooms or nursing units. When the timers go off, it gives an audio reminder to return the cooler of blood back to the blood bank where the products can be re-iced or returned to proper storage conditions. The UPMC PBM team decided to adopt and implement this QI project into their own blood banks within UPMC hospitals. The quality initiative was proposed in February 2020 and was set to take action on March 1, 2020.

However, before the timer QI project could be put into action, a detailed action plan had to be assembled. This plan outlined the project goals, what specific timers would be used, how the timers work, who would set the timers and turn them off, and which hospitals would use the timers. Adiah had her staff on board and the UPMC PBM team was ready to implement this quality initiative. Since putting the timers on the blood bank coolers, Adiah has announced that her staff is doing great with the timers. Overall, this QI project has shown success in ease of implementation and will stay in place for the foreseeable future.

### **9.3 2.0mL EDTA Lavender Top Tubes**

Patients admitted in the hospital regularly get their blood drawn into test tubes for laboratory testing. One of the most common tests for patients who are anemic, critically ill, received a blood transfusion, or who have cancer is a complete blood count (CBC). A CBC measures the essential components of blood including red blood cells, white blood cells, and

platelets. It is usually drawn into a 3.0mL EDTA lavender top tube and tested in the Hematology Department in the Automated Testing Laboratory. While 3mL of blood may not seem like very much to the average person, for critically ill patients, every milliliter of blood can make an impact on their health.

The UPMC PBM team makes an extreme effort to find ways to conserve blood for those patients who have received transfusion medicine or who are at risk to receive transfusion medicine. Critically ill patients in the hospital may have an average of 5-24 samples drawn in a single day (Wendling, 2019). The cumulative blood loss for a critically ill patient with a long hospital stay can be quite significant. As a blood conserving-strategy, the UPMC PBM along with the buy-in of other physicians decided to pilot the use of 2.0mL EDTA lavender top tubes in replacement of the 3.0mL EDTA lavender top tubes.

The pilot took place from September 2019-February 2020 in UPMC Presbyterian's transplant intensive care unit (TICU). The nurses and phlebotomists were to only use the 2.0mL EDTA lavender top tubes for every patient in the TICU. The UPMC PBM team collaborated with laboratory leadership to determine the overall effectiveness and if more EDTA lavender top tubes were rejected from the laboratory due to an insufficient quantity of blood in the tubes needed for hematology testing or if the sample was clotted.

At the end of the pilot, it was attested that the providers collecting the blood in the 2.0mL tubes did not encounter any collection problems because of the tube size. Data collected from the pilot in December 2019 indicated 0.97% tubes were clotted (5 recollects) and 0% quantity not sufficient (QNS). February 2020 pilot data indicated that 0.68% tubes were clotted (3 recollects) and 0% QNS. Retrospective 2019 data demonstrated a range of 1-8 QNS recollections with a median of 3. It was agreed and concluded that the 2.0mL lavender top tubes should not



significantly impact the clotted specimen recollection rate. From those conclusions, laboratory leadership and the UPMC PBM team decided to continue the use of the 2.0mL EDTA lavender top tubes.

#### **9.4 Quarterly Avoidable Blood Waste Dashboards**

Mentioned previously, for QI projects, it is an important factor to simplify processes and have information readily accessible for those who need it. Having information and statistics clearly visible to those most involved in a process allows for transparency, an environment more open to change, and overall improved awareness. As avoidable blood waste continues to occur at UPMC hospitals, the UPMC PBM team decided it would be an effective quality initiative to give the leadership most involved in avoidable blood waste a tool to see the overall picture and statistics of avoidable blood waste occurring in UPMC hospitals.

Dashboards are used for almost everything in health care. From determining health insurance needs to tracking hospital acquired infections, dashboards are a great analytic tool to measure performance rates in just about anything. The UPMC PBM team decided to create avoidable blood waste dashboards to give to the Chief Nursing Officers (CNO) of Vitalant-served UPMC hospitals. Providing CNOs with a dashboard of the most useful statistics regarding avoidable blood waste, will allow the CNOs to see exactly what processes need to be improved with their staff and hospital in order to reduce avoidable blood waste.

The Avoidable Blood Waste Dashboards needed to show relevant statistics for individual UPMC hospitals and the UPMC System. Providing the CNOs with data from their specific hospital allows for benchmarking between their hospital and the entire UPMC system. The dashboards also

needed to be accurate, easy to read with clear depictions of statistics, pleasing to the eye, and provide helpful information on how to reduce avoidable blood waste. The UPMC PBM also decided to deliver the dashboards on a regular monthly basis to provide consistent information.

With this in mind, the first step in creating the dashboards was extrapolating raw data from Cognos Reports and Microsoft Teams. Cognos Reports and Microsoft Teams provided data on how much avoidable blood waste was occurring and what hospital units it was coming from. From RCA reports that Deb Tatro provides, the data could be manipulated into categories as to why the avoidable blood waste was occurring. By having the data ready and organized the next step of designing the dashboards could begin.

The first part in designing the dashboards was to determine what information would be the most beneficial in showcasing to the CNOs. After much thought and collaboration, it was decided to put the location of where the avoidable blood waste occurred, the rate of waste for each specific blood component, how much money the wasted blood products cost, why the waste occurred, the hospital's RCA ratio, and a helpful tip to reduce the amount of avoidable blood waste.

The next step of the design process was to create statistical visuals so that the information was easy to read with a cohesive color scheme. Color coded bar graphs were used to show how many units of the specific blood components were wasted, where the waste occurred, and the Vitalant-served hospitals' RCA ratio. Picture icons of a timer, cooler, computer, and pneumatic tube were used to depict the cause of the wasted blood units. Lastly, a table was set up to show the financial losses the avoidable blood waste units had caused the organization. The color scheme of the dashboards was from approved UPMC colors that were bright and pleasing to the eye.

Once a preliminary version of the dashboards was created it was important to get feedback from potential stakeholders. The dashboards were sent to two CNOs from Shadyside hospital.

They reviewed the dashboards and agreed that they would be very useful to provide to all CNOs in UPMC Vitalant-served hospitals, but also suggested some minor adjustments. The adjustments were applied to the dashboards and the last step of finalizing the dashboards could proceed.

The Avoidable Blood Waste Dashboards were presented to Tami Minnier and all other peers at a deep dives meeting held at the Wolff Center in February 2020. Every member of the meeting received a finalized version of the individual hospital dashboard and the UPMC System dashboard for the month of January 2020. Overall, Tami liked the dashboards. Her feedback was to condense both dashboards to one page and remove excess text. She also suggested that the dashboards provide data from a quarterly, instead of monthly, basis. The UPMC PBM team considered this QI project a great success and eagerly made the adjustments to the now Quarterly Avoidable Blood Waste Dashboards. In the future, the Wolff Center is looking to automate the dashboards. Until then, typed directions and Excel spreadsheet templates were made so that the QI project could be sustained and continue to provide CNOs the necessary information they need in order to reduce avoidable blood waste.

## **10.0 Outcomes**

Each QI project that was implemented into the avoidable blood waste toolkit showed signs of success. While the biggest indicator of proven success is the decrease in overall avoidable blood waste throughout the UPMC system, it is known that reducing avoidable blood waste will always be an ongoing process. It is unlikely that avoidable blood waste will ever be 0% but UPMC is striving to get as close to 0% as possible. Before and during the early stages of the Avoidable Blood Waste Toolkit, the avoidable blood waste rate from January to June 2020 was 1.493%. A total of 678 units of blood were wasted and 44,378 total units of blood were transfused. Within a year of the implementation of the Avoidable Blood Waste Toolkit, the avoidable blood waste rate from January to June 2021 was 0.158%. A total of only 23 units of blood were wasted and 14,517 blood units were transfused. The 68% reduction in blood transfusions can most likely be attributed to the Covid-19 pandemic and better ordering skills from providers.

Many other signs of success can be documented or measured throughout the QI project processes. The outcomes of QI projects are also dependent on many other, sometimes uncontrollable, factors such as, timing, setting, and political environment. For these reasons, it is important to implement projects that are sustainable and will provide long term benefits.

The first sign of success for a QI project is stakeholder buy-in. For the turnaround times and expectations fliers and for the timers on the blood bank coolers, it was imperative that the Vitalant blood bank staff was on board. At my full-time job at UPMC Presbyterian's Automated Testing Laboratory when working in UPMC Presbyterian or Montefiore's blood gas lab, I often get to interact with the Vitalant blood bank staff who had anecdotally told me that they liked the idea of having a visible turnaround time flier. Being able to communicate to the Vitalant staff as

clinical healthcare workers provided a safe space where the Vitalant staff could voice improvements to the project or voice concerns that I could then take back to the Wolff Center and present them to the PBM team. Having this unique position, I was able to provide input on the implementation to the timers on the blood bank coolers. At work, seeing the actual use of the fliers and timers on the blood bank coolers, proves that these QI projects have been successful for two years now, and have a lasting impact.

The 2.0mL EDTA lavender top tubes show a different success story when it comes to saving blood. It was considered a success when the 2.0mL lavender top tubes only showed a slight increase in the amount of rejected samples from the automated testing laboratory, though the exact reasoning could not be pinpointed to the size of sample tube. This quality initiative saves TICU patients 1mL of blood each time their blood is drawn for testing. From this initiative, it is saving TICU patients' blood so that they would not need to have a possible blood transfusion. Far more studies would have to be done in order to calculate the amount of possible blood conserved from the hospital's blood supply, but overall, it can be concluded at large that the 2.0mL lavender top tubes do not harm the TICU patients and save 1mL of blood each time a CBC is drawn.

The quarterly avoidable blood waste dashboards showed success first from the two UPMC Shadyside CNOs and second the approval from Tami Minnier. To gain feedback from a clinical standpoint and UPMC's Chief Quality Officer, lets the PBM team know that this tool will provide helpful information that highlights statistics in hopes of changing provider behavior.

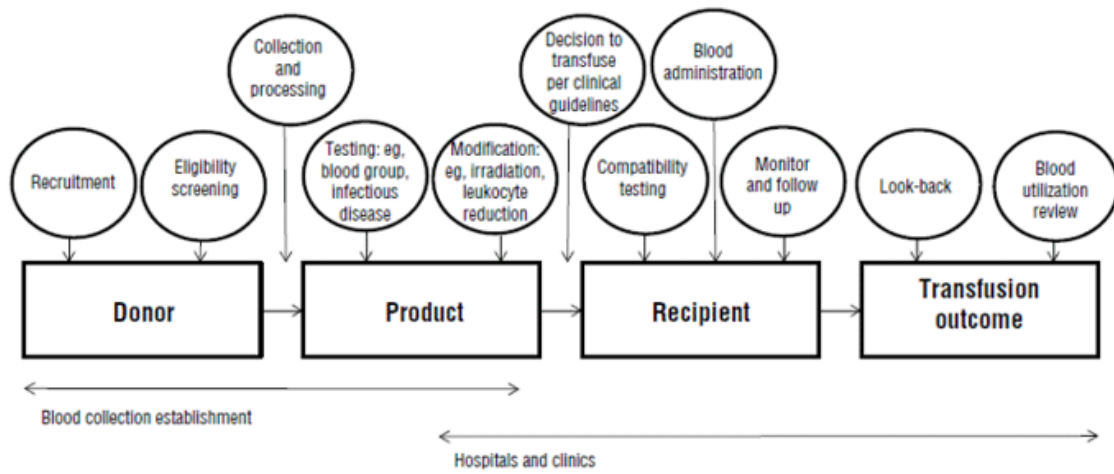
The timing and setting of when QI projects take place greatly affects how successful the QI projects will be. In March 2020, in the midst of creating the avoidable blood waste toolkit the COVID-19 pandemic started to become a real threat to the United States. The UPMC Wolff Center had basically paused every project that was being worked on and focused their attention on

whatever needed to be done for UPMC to battle COVID-19. The avoidable blood waste toolkit was paused as the top priority of physicians and Vitalant blood bank staff was not in the right place. The months following March 2020, because of the pandemic, our nation's blood supply has taken a massive hit. The nation's blood supply is at an ultimate low which only highlights the importance and need for QI projects, like the avoidable blood waste toolkit.

Since then, initiatives on the avoidable blood waste toolkit have resumed. All four QI projects in the avoidable blood waste toolkit have remained in use, proving their sustainability. The work of QI is truly rewarding, knowing the wide range of individuals it can affect and the lasting impacts it has on the health system.

## **11.0 Conclusion**

The use of quality improvement within integrated health delivery systems is launching health care in a more patient focused approach. With increased patient centered care, comes a cascade of other meaningful benefits for the entire health system. The UPMC PBM team has recognized the plethora of benefits and has taken an extreme amount of effort to apply quality improvement initiatives in the field of transfusion medicine. The UPMC PBM team's successful QI projects' benefits have only been amplified due to the COVID-19 pandemic. With a dedicated PBM team and limitless boundaries of QI, the future remains hopeful to continuously improve the patient experience at UPMC hospitals.



**Figure 1: Transfusion Medicine Process**



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