

# Economic Impact of Blood Transfusions: Balancing Cost and Benefits

## *Kan Transfüzyonun Ekonomik Etkisi: Maliyet ve Yararı Dengelemek*

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### Abstract

Blood transfusions may be lifesaving, but they inherit their own risks. Risk of transfusion to benefit is a delicate balance. In addition, blood product transfusions purchases are one of the largest line items among the hospital and laboratory charges. In this review, we aimed to discuss the transfusion strategies and share our transfusion protocol as well as the steps for hospitals to build-up a blood management program while all these factors weight in. Moreover, we evaluate the financial burden to the health care system.

**Key Words:** Blood transfusion, cost effectiveness, surgery

### Özet

Kan transfüzyonu hayat kurtarıcı olabilir bunun yanında transfüzyonun kendi risklerini de taşır. Transfüzyonun yararı ve riski arasında hassas bir denge vardır. Buna ilave olarak kan ürünlerinin transfüzyonu en büyük hastane ve laboratuvar harcamalarından birini oluşturur. Bu derlemede transfüzyon stratejilerini ve hastanemizde kullandığımız transfüzyon politikası ile hastanelerin kan yönetim programlarını oluşturmak için gereken basamakları tartışmayı amaçladık. Buna ilave olarak sağlık kurumlarına olan finansal yükü değerlendirdik.

**Anahtar Kelimeler:** Kan transfüzyonu, kar etkinlik, cerrahi

### Introduction

Patients undergoing surgical procedures occasionally require blood or blood products. This is not only limited to intraoperative complications, but includes pre-operative preparation as well as post-operative care.

Oxygen delivery to the tissues is the most critical point for the organism. Therefore, surgeons aim at the maximal support for their patients and may prefer blood transfusion before, during and after surgery to maintain oxygen delivery, which may prevent unfavourable outcomes [1]. Although blood transfusions may be lifesaving, they inherit their own risks [2, 3]. Risk of transfusion to benefit is a delicate one [4]. In addition, blood product transfusions purchases are one of the largest line items among the hospital and laboratory charges. This review will focus on the transfusion strategies and share our transfusion protocol as well as the steps for hospitals to build-up a blood management program while all these factors weight in.

### Transfusion

According to the World Health Organization definition, anaemia is having a haemoglobin level lower than 12 g/dL

in women and lower than 13 g/dL in men. Anaemia may be present in 5-75% of patients who undergo elective surgery, depending on many factors including population characteristics, the patient's age and illness [5]. Moreover, patients with chronic illnesses such as chronic obstructive pulmonary disease (COPD), and heart failure make the situation more complicated, depending on the severity of the co-existing illness, since transfusion is a complex procedure and it is difficult to generalize the criteria. However, we will share our transfusion criteria in the University of Texas Medical Branch with the reasoning behind it (Table 1).

### Building Transfusion Committees

The criteria's for the transfusion is variable among clinics. However, hospitals need to make an effort to build up their own transfusion committees. Therefore, the first step will be the baseline of evaluation of current blood use, patient outcomes as well as the costs by this committee. Afterwards, hospitals should compare their data against external benchmarks to determine their performance levels. The same committee will consist of a multidisciplinary medical staff to develop guidelines for transfusions and ensure that the guidelines are followed. Secondly, this transfusion

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**Table 1. Criteria for transfusion**

<b>Red Blood Cells</b>	Haemorrhagic shock Rapid active bleeding with medical compromise due to anaemia Haemoglobin level <7 g/dL in asymptomatic, normovolemic patient Haemoglobin level <8 g/dL with medical compromise due to anaemia Haemoglobin level <8-10 g/dL and anticipated intraoperative blood loss requiring definite transfusion Haemoglobin level <8-10 g/dL with central nervous system symptoms Haemoglobin level <8-10 g/dL with hypoxemia due to anemia Haemoglobin level <8-10 g/dL with other risk conditions Haemoglobin level <8-10 g/dL with sepsis or sepsis like conditions and peripheral vascular resistance
<b>Platelets</b>	Platelets $\leq$ 10,000 with thrombocytopenia Platelets $\leq$ 10,000 with bleeding due to thrombocytopenia or from pharmacologic or pathologic platelet dysfunction Platelets $\leq$ 50,000 with active haemorrhage or potential to bleed from invasive procedure Platelets $\leq$ 100,000 intracranial haemorrhage, neurosurgery/ophthalmic surgery patients Platelets >100,000 with evidence of platelet dysfunction and no response to desmopressin or cryoprecipitate
<b>Plasma</b>	Dilutional coagulopathy, active bleeding, surgery or invasive procedure and at least one of the following: PT >20 seconds aPPT >57 seconds Clotting factor deficiency ( $\leq$ 25% of normal) for which a safer replacement product is not available
<b>Cryoprecipitate</b>	Bleeding or potential for associations with surgery or invasive procedure and at least one of the following: Fibrinogen <100 mg/dL Fibrinogen <150 mg/dL and active haemorrhage in acute promyelocytic leukaemia Factor XIII deficiency (<25% normal) Platelets >100,000 with evidence of platelet dysfunction and not response to desmopressin available

committee need to develop working groups for specialties with the highest blood use, including cardiac surgery, orthopaedic surgery, critical care, trauma, gynaecology and oncology to identify the specific need of their speciality. After these steps, the transfusions in the hospitals, as well as the city and the country will be under control and patients and hospitals will have more benefits than before.

### Transfusion Strategy

Optimizing the haemoglobin level can be debatable although there is also questions on "What is normal?" The Transfusion Requirements in Critical Care (TRICC) trial revealed that a restrictive transfusion strategy was at least equally effective as a more liberal-transfusion strategy in critically ill anaemic patients [6]. In a Cochrane Database, transfusion strategies are discussed and it is concluded that restrictive transfusion strategies are associated with reduced transfusion rates and volumes while not worsening patient outcomes (including mortality, cardiac events, stroke, pneumonia and thromboembolism) and reducing infection rates [7].

However, Nichol et al. [8, 9] pointed out that it might be too early to lower the thresholds to 7 g/dL and support the restrictive transfusion strategy and concluded that physicians should ideally weigh the risk-benefit profile for each individual patient, for each unit of blood administered. At this point, this is to be a discussion for transfusion committees and their working groups in each individual institution.

### Transfusion and Minimally Invasive Surgery

In the field of surgery, there is an increasing trend recently toward minimally invasive techniques. Ancillary tools are growing in parallel to it to facilitate every aspect of the minimally invasive surgery (MIS), including laparoscopic and robotic surgery [10, 11]. The main advantages of MIS are reduced postoperative recovery period, blood loss, less hospital stay and better cosmetic results [12]. Therefore, liberal transfusion strategies may not apply to patients, especially who will undergo minimally invasive procedures. As MIS volume overtakes open surgery cases, it will be only natural to expect reducing the number of overused blood transfusions

as well as its inherited risks and costs. Moreover, preoperative treatments, iron treatments and nutritional supplements in order to try to maximize the patient's ability to get away with no blood transfusion should be one of the aims of the clinicians [13].

### Transfusion Costs

Conversely, every treatment has its own economic costs. Obviously, none of the costs are more valuable than the patients, however, clinicians and hospitals must be aware of their expenses to the health care system. It is known that 14,650,000 units of whole blood and red blood cells were transfused in the US in 2006 [14]. Toner et al. [15] pointed out that the mean acquisition cost per unit of red blood cells purchased from was found to be US\$ 210.74±38. Although this amount is the direct cost of the transfusion, it does not inherit indirect costs such as the need for hospital stay and nursing. There is no study evaluating the direct and indirect costs of transfusions in Turkey. However, according to the unpublished data from the Turkish Ministry of Health, it is estimated that nearly 2,200,000 transfusions will be achieved until the end of 2013 and the Republic of Turkey Social Security Institution pays nearly US\$ 50 for each red blood cell transfusion. Although the total cost including hospital stay, nursing and medication is very variable and is still unclear, it may be easily estimated that only red blood cell transfusion costs at least US\$ 100,000,000 yearly in Turkey. Taking this into account, transfusions are one of the major components of expenses in the healthcare system and clinicians should be aware of this. In addition, both the US and Turkey direct costs mentioned above do not include transfusion related complications, which will cause an extra burden of both cost and health care.

In conclusion, it is mandatory to improve financing and utilization management for blood components and services. Blood transfusion committees will have to take the first step for this matter and working groups will individualize the need for transfusion and transfusion strategies in order to maximize the patient's health at the minimum cost. Surgeons who will perform minimally invasive surgery and expecting a minimum blood loss may not be very ambitious to make transfusion and keep in mind that transfusion is liquid organ transplantation.

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