RECOMMENDATIONS FOR ESTIMATING THE NEED FOR BLOOD AND BLOOD COMPONENTS

Pan American Health Organization
Regional Office of the World Health Organization

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ACRONYMS

AABB	American Association of Blood Banks
AHA	American Hospital Association
AIDS	Acquired immunodeficiency syndrome
AML	Acute myeloid leukemia
ASCO	American Society of Clinical Oncology
CABA	Autonomous City of Buenos Aires, Argentina (Spanish acronym)
CNS	Central nervous system
CVS	Cardiovascular surgery
DHHS	Department of Health and Human Services
FFP	Fresh frozen plasma
ICD	International Classification of Diseases
INDEC	National Institute of Statistics and Censuses (Spanish acronym)
LAC	Latin America and the Caribbean
MH	Medical history
MSBOS	Maximum surgical blood order schedule
NA	Not available
NIH	National Institutes of Health
PAHO	Pan American Health Organization
PC	Platelet concentrate
PPH	Peripartum hemorrhage
PRBC	Packed red blood cells
SHOT	Serious hazard of transfusion
THS/EV	Technology and Health Services Delivery Area/Essential Medicines, Vaccines, and Technology Unit
TTI	Transfusion-transmissible infection(s)
TX	Transfusion
UGB	Upper gastrointestinal bleeding
UPRBC	Units of packed red blood cells
WHO	World Health Organization

INTRODUCTION

The transfusion of red blood cells, platelets, plasma and, when clinically appropriate, whole blood, is an essential practice for the care of patients with clinical conditions that cannot be treated with other health technologies (1-7). Therefore, having sufficient supplies of blood and blood components in hospitals is of critical importance for the health of the population.

The number of units of blood needed for transfusion in a specific country or community is not always directly related to the number of inhabitants. Rather, it depends on other factors. The prevalence rates of coagulopathies, health problems associated with the reduction of the oxygen supply to the organs and tissues, and homeostatic imbalances vary with the epidemiology of the factors that determine these disorders, the local capacity to diagnose them, and the coverage of the health services (8-21). In fact, although the application of some health technologies can reduce blood transfusions, there are certain medical and surgical interventions that clearly increase their need (22-38). Furthermore, it has been shown that there is interpersonal, interinstitutional, and international variability in the criteria used by health workers to prescribe transfusions for patients with similar diagnoses (39-47). Donation rates in the Region of the Americas demonstrate that the number of units of blood required for transfusions does not depend on the size of the population only (Table 1) (48-49).

The transfusion of blood components that are incompatible, either for biological reasons or due to administrative error, can provoke adverse reactions that range from minor to severe or even fatal allergic reactions. Moreover, the transmission of infectious agents - such as the viruses that cause human immunodeficiency, hepatitis B, hepatitis C, and dengue, as well as *Trypanosoma cruzi* - through the transfusion of infected or contaminated blood is considered to be a risk with serious consequences (50-71).

The health services should always have sufficient supplies of blood components that are compatible with the blood type of the recipients, effective for treating the physiological deficiencies of patients, and free of harmful agents. Moreover, in order to provide safe, effective, and timely transfusions, the health services should consider the appropriate time periods and storage conditions for each type of component from the time of its preparation and the circumstances in which the transfusions can and should be administered based on the sex, age, and medical history of the patient. It is clear that the collection and processing of blood by the blood services that supply blood components to hospitals should be planned and implemented with these considerations in mind (72-75).

Table 1. Blood donation rates in the Region of the Americas (per 10,000 inhabitants) 2000-01, 2006-07

Country/Territory	2000-01	2006-07
Cuba	538	355
United States	459	NA
Curaçao	407	369
Aruba	350	NA
Uruguay	350	276[a]
Canada	327	NA
Anguilla	206	81
Bermuda	166	NA
Brazil	161	163
Chile	154	143
Panama	153	140
Costa Rica	149	121
Cayman Islands	124	216
Saint Lucia	121	134
Barbados	120	154
Belize	120	112
Bahamas	119	161
Trinidad and Tobago	116	158
Antigua and Barbuda	112	143
Venezuela	112	151[a]
El Salvador	111	119
British Virgin Islands	110	227
Colombia	104	119
Dominica	99	105
Mexico	97	141
Peru	97	64
Saint Vincent and the Grenadines	94	98
Argentina	90	177
Ecuador	90	108
Nicaragua	90	107
Grenada	87	96
Jamaica	83	86
Paraguay	79	89
Honduras	53	74
Suriname	52	195
Bolivia	50	58
Guatemala	41	57
Turks and Caicos Islands	35	NA
Saint Kitts and Nevis	35	106
Guyana	32	96
Dominican Republic	30	48
Haiti	8	17

[a] *Data for 2005. Source: Adapted from references 48, 49.*

> Planning for blood collection, as well as for the preparation and distribution of appropriate quantities of blood components, implies recognition that repeated non-remunerated altruistic blood donation by healthy, well-informed individuals is the most important factor in ensuring a timely and sufficient supply of safer blood components (76).

Therefore, it is necessary to establish policies and services to educate people about the importance of contributing to the creation of an adequate supply - in terms of quantity and quality - of hospital supplies of blood components. Policies and services should also ensure donor satisfaction, protection, and safety to promote repeated blood donation (76). The education of the population and the recruitment, selection, care, and retention of donors entail investments in personnel, supplies, equipment, and services that are not traditionally associated with the health sector but should be included in the budget of the respective ministry.

Planning the efficient preparation and distribution of safe blood components also entails adopting systems that guarantee the quality of the laboratory procedures for the separation of blood components and immunohematological and infectious analyses, as well as the proper conditions for the subsequent storage and transport of the products. Quality assurance systems include internal control, external evaluation of performance, audits, and the continuing education of personnel, activities that require a financial investment. This investment is compensated for by a reduction in the burden of unnecessary waste and, more importantly, the financial and human costs of providing care to patients with adverse reactions to transfusions.

The appropriate use of blood components in a hospital is critically important to a sustainable supply that is available when needed.

> Given the variability in prescription criteria, clinical guidelines for the appropriate use of blood are needed to assist physicians in deciding whether to prescribe a transfusion or use other interventions (77-82). The preparation and adoption of such guidelines should minimize the inappropriate use of blood components; this, in turn, will improve the clinical management of patients and result in savings for the health system (83). Patients should be encouraged to participate in their treatment, making them aware of the benefits and risks of transfusion and thus facilitating the informed consent process (84).

One of the first evidence-based recommendations that changed deeply rooted paradigms among anesthesiologists and surgeons was issued by a Consensus of the National Institutes of Health (NIH) in the United States in 1988 (85). For many years, the medical community took the view that patients should have at least 10g/dL of hemoglobin or a 30% hematocrit for surgery to be performed, arguing that these levels were critical for ensuring tissue oxygenation while under anesthesia. The authors of the Consensus refuted this concept, citing as examples the large number of patients who are Jehovah's Witnesses and the cases of severe kidney failure with hemoglobin levels or a hematocrit below these figures that had been anesthetized with no adverse consequences (85). They therefore recommended that the preoperative hemoglobin threshold be lowered to 8 g/dL.

They also recommended that, in deciding whether to transfuse, consideration be given to the duration of anemia and the presence of other conditions that affect tissue oxygenation, such as abnormal lung function, myocardial ischemia, and peripheral or cerebral circulatory disease. Two other consensuses that were fundamental in the change of transfusion triggers were those on the use of plasma and the use of platelets, published in the 1980s (86, 87). More recently, several documents with recommendations for the transfusion of platelets have been published, notably the guidelines of the American Society of Clinical Oncology (ASCO) (88).

Furthermore, there is evidence that a restrictive strategy for transfusing packed red blood cells (PRBC) in critical patients is at least more effective and probably better than the liberal strategy, with the possible exception of patients with acute myocardial infarction (89). Despite these observations, many patients undergoing elective surgery receive transfusions in order to reach hemoglobin levels that meet the criteria of the surgical-medical team, without considering that anemia could be treated with proper medication prior to surgery, thus preventing unnecessary transfusions (90).

Finally, strict monitoring and control of the storage and management of blood units to ensure that the blood components available in hospital services do not reach their expiration date and maintain their original therapeutic effectiveness contribute to an adequate supply of blood and its availability when needed while, at the same time, reducing the waste of valuable health system resources.

These considerations were analyzed in October 2008 by the 48th Directing Council of the Pan American Health Organization (PAHO) as part of the document on "Improving Blood Availability and Transfusion Safety in the Americas" (CD48/11), which states as follows:

Efforts should be made to estimate the annual national need for blood and blood components, by geographic area and by month. The national guides for clinical use of blood and the potential number of cases of the clinical conditions that require transfusions, including voluntary and involuntary injuries, should be used as the basis for the estimate. In order to cover unforeseen emergencies—natural or man-made disasters, infectious outbreaks, emergency vaccination campaigns—it is recommended that the national blood systems have an additional stock equivalent to 4%, or two weeks, of the annual need.

The annual estimates of blood needs should take into consideration the expected increases in (a) numbers of the general and elderly population; (b) social inclusion of currently excluded populations; (c) road traffic injuries; and (d) local adoption of medical technologies such as organ transplants. Sufficient financial resources to collect and distribute enough blood components should be made available to the corresponding responsible unit within the Ministry of Health. National financial resources that are currently being wasted should be invested towards this effort.

In addition, Resolution CD48.R7 (see Annex A) adopted by the PAHO Directing Council on 2 October 2008 on the basis of document CD48/11 urges the PAHO Member States to estimate their annual national need for blood components and the financial resources to cover these needs. This led to the decision to prepare recommendations to assist the countries of the Region of the Americas in making timely and effective estimates of their need for blood and blood components for transfusion.

PURPOSE

This document seeks to support the planning of activities by the blood programs and services in the Region of the Americas that supply blood to hospitals. Its contents are based on the premise that, to perform their functions more efficiently and effectively, supply centers must project the future need for blood components at the hospital level and, thus program more precisely the achievement of their goals.

When the quantity of blood components required in a given period is known with some certainty, it is much simpler to estimate not only the necessary budget but the size of the voluntary donor pool that will be needed to meet the collection goals. The data can also be used to determine how many mobile collections must be made and the number of vehicles, supplies, and personnel required for adequate blood collection, processing, and distribution. Using this information, hospital services can better plan their need for equipment, reagents, consumables, and the laboratory personnel needed to perform the transfusions.

It is essential that need estimates be based on the appropriate use of blood components, which have great therapeutic value but entail high production costs apart from the potential to provoke undesirable side effects in patients. This requirement involves answering the following questions: Was the appropriate threshold selected when deciding to prescribe a blood component? Were volume expanders used when clinically indicated? Were scheduled surgeries cancelled when the patient had nutrient-deficiency anemia? Was autologous transfusion considered before surgery?

Another advantage of having prior knowledge of the amount of blood components required (by sex, age, and clinical condition) is that it can be used to develop indicators of the coverage, efficiency, effectiveness, and safety of transfusion services. In this regard, it is worth noting the observation made by Wells in his article "Who uses blood?" (91), in which he gives an example of the lack of consistency that reports of hemovigilance systems can have when they lack information on the number of transfused recipients and the number of blood components administered to them. For example, the Fifth Report of SHOT (Serious Hazards of Transfusion), the hemovigilance system of the United Kingdom, indicated that 8.6% of the incidents occurred in patients under the age of 18, an age group in the north of England that receives only 3.8% of all units of packed red blood cells (UPRBC) (92).

What led PAHO to develop a model to estimate blood needs and recommend its use by the countries of the Region of the Americas?

In general, one of the weaknesses of national blood systems in the Region of the Americas is the lack of essential data for making this estimate. Therefore, PAHO decided to provide the countries with a tool to assist them with these calculations, relating the clinical conditions and interventions that require transfusions and their prevalence by age and sex at the hospital level in different regions of the country, with the indications on the appropriate use of blood components found in the clinical guidelines adopted by each country.

> The proposal is that hospitals obtain information on the use of blood components for their patients and that they validate the coverage and relevance of their transfusion practices. Additionally, each hospital should submit the information to the appropriate health authority, so that databases can be developed for use in estimating the need for blood for transfusion purposes in a given jurisdiction, region, or country.

Such calculations should first be validated in the field, verifying whether the estimates will actually meet the needs of the patients. As a second step, the estimates should be evaluated through the medical history of the transfused patients to determine whether the transfusions were warranted and if the clinical response was satisfactory. There is abundant literature showing the high tolerance of patients to low hemoglobin levels without affecting tissue oxygenation, as well as reports of patients that do not receive transfusions when they need them (93, 94). There are also indications that high maternal mortality is associated with the limited availability of blood for transfusions (95). The first two circumstances illustrate the complexity of establishing strict transfusion guidelines when the clinical condition of each patient is not taken into consideration, whereas the third is a clear demonstration of the need to expand health services coverage to include a significant segment of the population that has limited access to care.

According to Sullivan and Wallace (96), an adequate supply of blood in a country depends on the margin between the availability of allogenic blood and the demand for transfusions, since allogenic blood is used in 97% of transfusions. Although the low percentage of autologous blood transfusion, 3%, may be applicable to most hospitals worldwide, the assumption is not entirely valid for the countries of the Region of the Americas, since there are differences among jurisdictions with regard to the rate at which donated blood is fractionated into components. Therefore, they may not have enough packed red blood cells or platelet concentrates if production is not planned on the basis of specific estimated use.

The most commonly used blood components are packed red blood cells (PRBC), platelet concentrate (PC), and fresh frozen plasma (FFP). PRBC are indicated when it is essential to increase oxygen transport to the tissues in situations of severe anemia. Platelet concentrates should be given when low platelet counts, clinical status, and the imminence of a medical intervention indicate that the patient is at risk of bleeding. Finally, FFP should only be prescribed when hemorrhages are associated with a severe deficit of multiple coagulation factors (3). Use of FFP as a volume expander or a source of a single coagulation factor, immunoglobulin, or protein is contraindicated.

RATIONALE

Background to evaluation of the need for blood

An extensive review of the literature identified several approaches to estimating blood and blood component needs. For this document, the recommendations of the World Health Organization (WHO), epidemiological studies conducted to project short- and medium-term blood needs, and specific proposals to use the number of patients admitted to hospitals as the reference value were considered (97).

Some studies have explored the use of blood components based on the International Classification of Diseases (ICD-10) (98). Only one of the experts consulted in a survey by Cobain et al. (99) provided responses based on the ICD-10 codes. In response to the question about which diseases and procedures consume the most blood components, the authors reported that 93.9% of the transfusions of PRBC administered to patients corresponded to the following 12 chapters of the ICD-10:

- Neoplasms
- Diseases of the digestive system
- Diseases of the circulatory system
- Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism
- Injury, poisoning and certain other consequences of external causes
- Factors influencing health status and contact with health services
- Diseases of the musculoskeletal system and connective tissue
- Symptoms, signs and abnormal clinical and laboratory findings, not classified elsewhere
- Diseases of the genitourinary system
- Diseases of the respiratory system
- Certain infectious and parasitic diseases
- Endocrine, nutritional and metabolic diseases

Wells et al. (92) grouped the conditions that require transfusions into three major categories: clinical, surgical, and obstetric-gynecological, and included transfusions given to neonates among the clinical needs (Table 2).

TABLE 2. **Categories of medical specialties used to estimate the need for blood and the percentage of units used** [a]

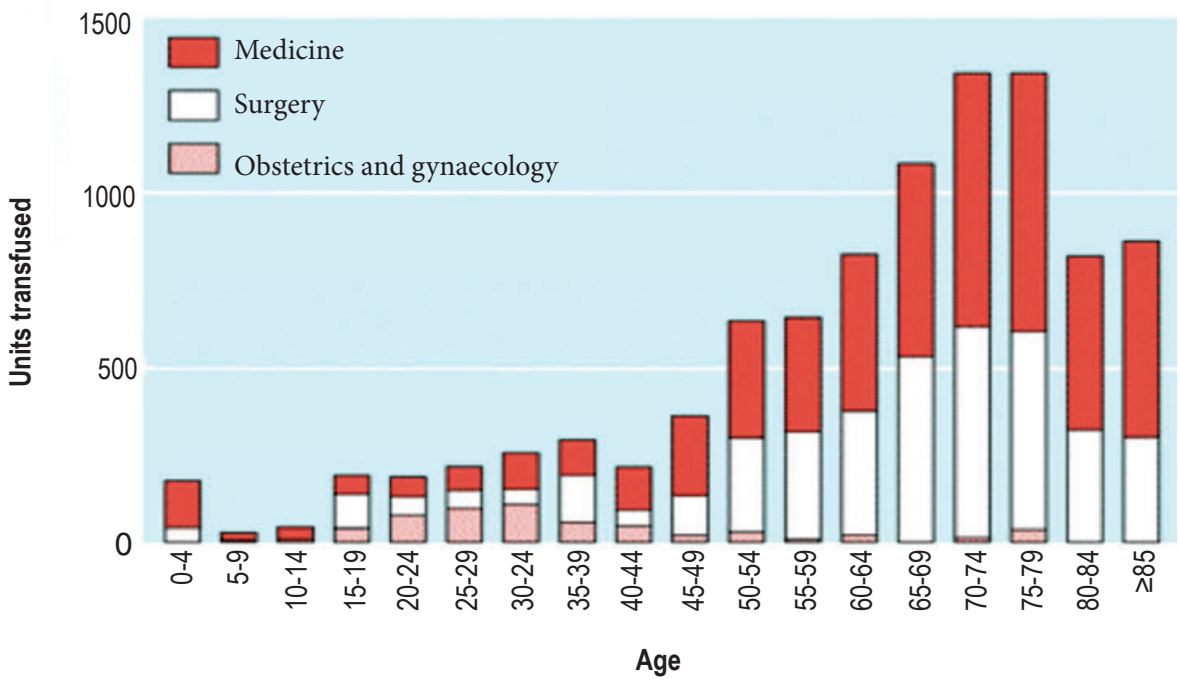
Medicine	Proportion (%))	Surgery	Proportion (%)	Gynecology-obstetrics	Proportion (%)
Anemia	23.0	Orthopedics and trauma	**13.9**	Gynecology	3.1
		Hip replacement	4.6		
		Femoral fracture	1.8		
		Knee replacement	1.6		
		Traffic accident	1.4		
		Other	4.4		
Hematology	15.5	General surgery	**9.6**	Obstetrics	3.1
		Abdominal surgery	4.4		
		Colorectal surgery	2.7		
		Other	2.4		
Gastro-intestinal bleeding [b]	10.8	Cardiovascular surgery	**6.1**		
		Coronary bypass	4.1		
		Other	2.1		
Others	1.5	Vascular surgery	**4.6**		
		Emergency aortic aneurysm	2.3		
		Other	2.3		
Neonatal/ Exchange-transfusion	0.6	Urology	2.6		
		Transplants	1.7		
		Neurosurgery	1.2		
		Ear, nose and throat	0.6		
		Plastic surgery	0.5		
Total	51.6	Total	40.7	Total	6.3

[a] *Use of 3% of UPRBC is unknown.*

[b] *Includes clinical and surgical patients.*

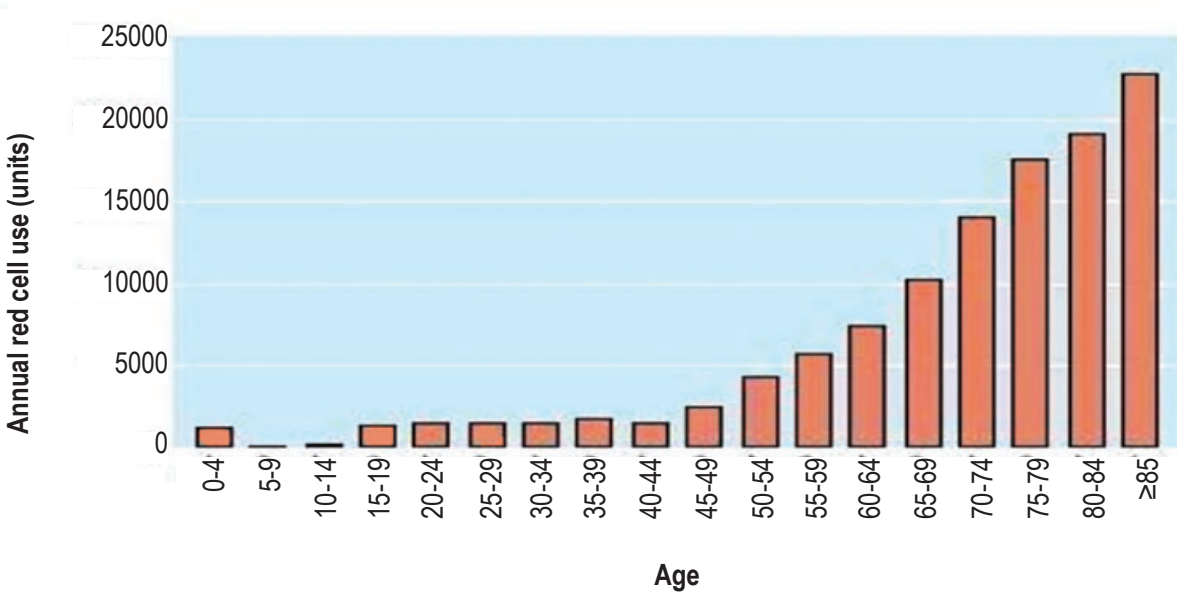
In addition, the age and sex of transfusion recipients were also examined (92). A similar analysis is particularly critical for countries in the Region of the Americas in which the percentage of age groups over the age of 60 is much lower than that reported in Australia, Europe, and the United States (99, 100). For example, in 2002 the population over 60 years of age in Funen County, Denmark received 72.9% of the transfusions. It has also been shown that the patients less likely to receive transfusions are children under 15 (92). Figure 1 shows blood consumption by age and specialty. Consumption of PRBC by age per 100,000 inhabitants is shown in Figure 2.

FIGURE 1. Blood use by age and specialty



Source: reference 92, authorized reproduction.

FIGURE 2. Age specific transfusion rates (annual red cell use per 100,000 population)



Source: reference 92, authorized reproduction.

Data based on the actual transfusion practice at the hospital level can be used to measure the current need for blood and blood components in a given geographic area, and to estimate future demand by making adjustments for projected demographic changes in the target population (Table 3).

TABLE 3. Regional population by age group and estimated use of red blood cells, 1999-2000, 2003, 2008

Age (years)	1999-2000		2003		2008	
	Population (in thousands)	Estimated annual use of red blood cells	Estimated population (in thousands)	Estimated annual use of red blood cells	Estimated population (in thousands)	Estimated annual use of red blood cells
0-4	169.4	2,177	159.3	2,047	154.1	1,980
5-9	189.3	339	169.3	303	159.3	285
10-14	191.4	574	188.6	565	169.0	506
15-19	187.2	2,490	193.2	2,570	191.6	2,548
20-24	164.9	2,451	183.5	2,727	190.2	2,827
25-29	203.1	2,855	155.8	2,190	170.9	2,402
30-34	223.7	3,350	203.0	3,040	156.1	2,338
35-39	221.4	3,832	223.4	3,867	202.9	3,512
40-44	200.0	2,859	220.3	3,145	222.6	3,177
45-49	194.1	4,745	197.1	4,818	217.6	5,319
50-54	193.1	8,356	190.4	8,239	193.8	8,386
55-59	152.2	8,486	187.9	10,477	185.4	10,337
60-64	148.2	10,741	144.9	10,502	179.7	13,025
65-69	140.8	14,183	136.7	13,770	134.8	13,578
70-74	124.8	17,468	121.9	17,062	120.6	16,880
75-79	100.3	17,559	97.8	17,121	98.1	17,174
80-84	56.1	10,663	68.8	13,077	68.7	13,058
≥ 85	49.4	11,224	49.8	11,315	57.7	13,110
Total	2,909.4	124,348	2,891.7	126,835	2,873.1	130,444

Approaches used in the past

Approach 1

WHO publications propose various methods for estimating the need for blood for transfusion (101-104). One such method consists of determining the number of units of blood components transfused in a geographical or administrative region during a given period and projecting this figure as the estimated future demand. The second method proposed considers the number of hospitals beds as the determinant of blood need and consists of multiplying the number of hospital beds by 7, or multiplying the number of hospital beds used to provide care for acute patients by 6.7 or by 10. Another proposal is to estimate that 0.40 donations are required for each patient admitted to a hospital, a method that coincides with that of Leikola et al. (97). Finally, WHO has suggested that it is necessary to collect units of blood equivalent to 5% or 2% of the population. More recently, it has indicated that the minimum donation rate to cover the most basic requirements of a nation is 1% of its population (104).

Approach 2

A more recent approach proposes consulting professionals with recognized clinical experience to determine past transfusion practices in hospitals and the perceived prevalence of conditions in the population that require transfusions. In 2004, this approach began to be used in Honduras and Argentina by Elizabeth Vinelli and Ana del Pozo, respectively, for the purpose of validating the simplified model designed by R. Salmi and B. McClelland. Although not published, the model was presented in the context of the WHO Global Collaboration for Blood Safety in 2003.

The studies in Honduras and the Autonomous City of Buenos Aires (CABA), Argentina consisted of surveys, the Delphi methodology, and consensus meetings with experts from the specialties that prescribe transfusions most often. The purpose of the consultations was to determine the clinical conditions that require the highest percentage of units of blood, the number of patients that receive transfusions, and the average number of transfused units for each patient. The results of the surveys and the expert consensus were validated in the field by reviewing medical histories or blood bank records. The figures obtained were used to estimate the need for PRBC in the population of Honduras and CABA. Table 4 summarizes the findings for CABA.

TABLE 4. **Annual need for PRBC, in relation to the total units used and number of inhabitants in the Autonomous City of Buenos Aires, 2007**

Patient group	Prevalence (%)	Percentage (%) of transfusion recipients	Average UPRBC administered per patient	Total UPRBC	Total (%)
Chronic anemia	0.0022	53.72	8.23	27,002	35.82
Oncology/hematology	0.00047	63.70	11.38	9,458	12.55
Solid organ tumors	0.00711	19.93	2.36	9,270	12.30
Cardiovascular surgery	0.00136	70.00	3.00	7,928	10.60
Trauma and other injuries	0.00258	40.94	2.33	6,831	9.06
Orthopedics	0.005	30.30	1.43	6,014	7.98
Gastrointestinal bleeding	0.001	58.91	2.61	4,268	5.66
Sick neonates	0.00102	37.57	2.50	2,659	3.52
Obstetrics-gynecology [a]	0.001	20.35	1.98	1,118	1.48
General surgery	0.001	24.50	1.20	816	1.08
Total				75,364	100

Source: Personal communication, del Pozo A., Buenos Aires, Argentina.
[a] Gynecological tumors were included in the obstetrics/gynecology group.

The weakness of this calculation model is that the data on the prevalence of medical conditions, the proportion of patients that receive transfusions, and the number of units used per patient is limited to the population of the city, which is less than 2.8 million inhabitants. In fact, the CABA hospitals also provide care for people from Buenos Aires province and neighboring countries. An estimated 50% of the patients that receive care in CABA hospitals come from outside the city.

In 2007, when the validation study was conducted, the CABA Hemotherapy Network reported that 55,957 UPRBC and 412 units of whole blood had been transfused in the city's public hospitals (105). These figures do not include private hospitals, where consumption is probably greater than or at least equal to that of the public hospitals. Therefore, the estimate of 75,364 units of PRBC is well below the actual use. In addition, when the estimates made by the expert consensus were validated with the information from the medical histories, it was found that the experts in Buenos Aires had failed to include some conditions, primarily those related to general surgery and dialysis that require transfusions of PRBC.

Approach 3

Another approach is based on the use of blood in hospitals, corrected for the percentage of patients that do not live in the jurisdiction where the hospital is located. In Funen, Denmark, 33% of the transfusions were excluded because they were administered to patients that did not live in that county, which facilitated calculation of the need based on the number of inhabitants (99). Currently, in Latin America and the Caribbean it is extremely difficult to relate the number of UPRBC used in major cities to the number of inhabitants in the city because, as shown in the case of Argentina, its public as well as private hospitals provide care for patients from other provinces and even other countries.

The data used to estimate blood needs in Funen was:

- Population of Funen: 472,504 inhabitants.
- Transfusion recipients: 5,487 (this figure may not be accurate since PRBC, FFP, and platelets were counted separately).
- Transfusions of PRBC: 4,576 units in a year.
- Distribution of PRBC according to ICD-10: 93.9% of PRBC were administered to patients with neoplasms; diseases of the digestive system; diseases of the circulatory system; diseases of the blood and blood-forming organs and certain immune disorders; injury, poisoning, and other consequences of external causes; factors that influence health status and contact with health services, diseases of the musculoskeletal system and connective tissue; symptoms, signs and laboratory findings not elsewhere classified; diseases of the genitourinary system; diseases of the respiratory system; parasitic infections; and endocrine, nutritional and metabolic diseases. The others were connected with problems associated with pregnancy, childbirth, and the puerperium; diseases of the skin and subcutaneous tissue; diseases of the nervous system; mental illness; conditions originating in the perinatal period; congenital and chromosomal malformations; and diseases of the eye and adnexa.

It should be noted that the use of PRBC in pregnancy, childbirth and the puerperium (1.5%) as well as that associated with conditions originating in the perinatal period (0.2%) represented a very low percentage of the transfusions. The prevalence of disease and the number of recipients of PRBC in Funen are probably very different from those in the countries of the Region of the Americas.

APPROACH RECOMMENDED BY THE PAN AMERICAN HEALTH ORGANIZATION (PAHO)

In attempting to produce estimates and forecasts of the need for blood and blood components, whether at the country, state/province, or local level, it is important to review the epidemiological studies on transfusion practices in light of the variables of the age, sex, and medical conditions of patients that are the reason for the transfusions. Studies to determine the blood requirements of a particular institution or group of institutions, and not necessarily of a particular population, should be included in such a review (91, 92, 99, 106).

In 2007 the United States Department of Health and Human Services requested that hospitals and central blood banks throughout the country participate in a survey on blood use. Responses were received from 59.9% of the hospitals and 91.4% of the central blood banks in the country (107). The information submitted for the year 2006 by 1,597 hospitals indicated 8,275,000 allogeneic units of PRBC transfused to 2,740,000 patients, that is, an average of three units per patient. Patients that received autologous transfusions were given an average of 1.6 units each, whereas the average for pediatric patients was 2.7. When these figures were extrapolated to the country as a whole, it was estimated that there were 5 million recipients of units of whole blood and PRBC in a year, with a requirement of approximately 15 million units for the entire population.

The use of information obtained from a limited population sample without knowing how blood and blood components are used may lead to conclusions that are not applicable for estimating the need for blood and blood components in the general population (100). Some of the variables that can affect the accuracy of need estimates based on limited population samples are the prevalence of medical conditions that require transfusions, the relevance of using blood components, the use of red blood cell substitutes and volume expanders, differences in surgical techniques, the occurrence of natural disasters, epidemics of infectious disease, financial crises, and differences in the composition of the population.

As an example, Table 5 shows the age distribution in some Latin American countries and Funen County in Denmark. People over the age of 65 represent 5.41% of the total population in Argentina's Misiones province, 5.1% in Paraguay, 3.3% in Nicaragua, and 15% in Funen. The proportion of children under 14 in Denmark is lower than that in the Latin American countries, a fact that may

explain the differences in transfusion rates among sick neonates in Funen (Figure 1) and Argentina. The enormous variations in age distribution between the populations in the Latin American sites and Funen may be helpful when examining disparities in transfusion needs, because they are related to other indicators such as access to medical care, birth rates, maternal mortality, and life expectancy.

TABLE 5. Demographic differences between locations in Latin America and Denmark, 2001-03

Country/Province	Population	Age Group in Years		
		0-14	15-64	≥65
Denmark (Funen County)	5,343,000	961,740 (18.0%)	3,579,810 (67.0%)	801,450 (15.0%)
Argentina	36,260,130	10,247,695 (28.3%)	22,424,815 (61.9%)	3,587,620 (9.8%)
City of Buenos Aires	2,776,138	468,961 (16.9%)	1,828,732 (65.9%)	478,445 (17.2%)
Chaco	984,446	354,991 (36.1%)	569,039 (57.8%)	60,416 (6.1%)
Corrientes	930,991	321,583 (34.5%)	545,406 (58.6%)	64,002 (6.9%)
Misiones	965,522	364,827 (37.8%)	548,407 (56.8%)	52,288 (5.4%)
Nicaragua	5,785,846	2,001,903 (34.6%)	3,593,010 (62.1%)	190,933 (3.3%)
Paraguay	6,036,900	2,227,616 (36.9%)	3,501,402 (58.0%)	307,882 (5.1%)

Sources: INDEC, National Census of Population, Households, and Dwellings of Argentina, 2001.
Denmark data: Earth Trends 2003 (http://earthtrends.wri.org). Paraguay and Nicaragua data: CIA World Factbook https (http://www.cia.gov/library/publications/the-world-factbook/).

Taking the potential effects of age distribution among the general population into account, the patient classification described by Wells et al. (92), modified to have neonates as a separate group of patients, is proposed as a model for data collection. The separation of neonates from the obstetrics/gynecology group will allow local transfusion practices to be correlated with the clinical guidelines for the appropriate use of blood and blood components while highlighting an age group that merits special attention in the Region of the Americas. Current clinical guidelines for neonatal transfusions consider their clinical and surgical needs separately (2, 6, 18, 26, 29, 39, 72, 79, 80). It is therefore proposed that all newborns that require transfusions from birth until their discharge from the neonatology service and those who are readmitted to a hospital and transfused within 40 days of birth be included in the neonate group.

Groups of patients

In order to standardize the classification of hospital records into specific categories at the national and regional level, it is recommended that patients who receive transfusions be assigned to one of the following four groups: clinical conditions, surgical interventions, obstetric/gynecologic conditions, and conditions of the neonatal period. Parallel use of the International Classification of Diseases (ICD-10) codes is proposed (98).

Clinical conditions

Anemias and diseases of the blood

D50-D53	Nutritional anaemias
D55-D59	Haemolytic anaemias
D60-D64	Aplastic and other anaemias
D70-D77	Other diseases of blood and blood-forming organs
D80-D89	Certain disorders involving the immune mechanism
M00-M99	Diseases of the musculoskeletal system and connective tissue
N00-N08	Glomerular diseases
N17-N19	Renal failure

Surgery associated with these clinical conditions should not be considered in this group. All surgical procedures should be included in the "surgical interventions" category, under general surgery.

Leukemias and lymphomas

C81	Hodgkin´s disease
C82-C85	Follicular [nodular], diffuse, and unspecified types of non-Hodgkin's lymphoma. Peripheral and cutaneous T-cell lymphomas
C88	Malignant immunoproliferative diseases
C90	Multiple myeloma and malignant plasma cell neoplasms
C91	Lymphoid leukaemia
C92	Myeloid leukaemia
C93	Monocytic leukaemia

Non-hematologic malignant tumors (clinical needs)

C64-C68	Malignant neoplasms of urinary tract
C15-C26	Malignant neoplasms of digestive organs
C30-C34	Malignant neoplasms of nasal cavity and middle ear; accessory sinuses; larynx; trachea; and bronchus and lung
C53	Malignant neoplasm of corpus uteri
C55	Malignant neoplasm of uterus, part unspecified
C56	Malignant neoplasm of ovary
C69-C72	Malignant neoplasms of eye, brain and other parts of central nervous system
C43-C44	Melanoma and other malignant neoplasms of skin
C00-C14	Malignant neoplasms of lip, oral cavity and pharynx
C60-C63	Malignant neoplasms of male genital organs
C71	Malignant neoplasm of brain
C61	Malignant neoplasm of prostate

Anemia associated with gastrointestinal bleeding

K20-K31	Diseases of oesophagus, stomach and duodenum
K70-K77	Diseases of liver
K85-K86	Acute pancreatitis; other diseases of pancreas

Surgical interventions

Cardiovascular surgery

Anemia associated with cardiovascular surgery, which includes surgical interventions of the heart and blood vessels, as well as heart transplants.

I80-I89	Diseases of veins, lymphatic vessels and lymph nodes, not elsewhere classified
I05-I09	Chronic rheumatic heart diseases
I20-I25	Ischaemic heart diseases

Injury, poisoning, and other consequences of external causes

This group includes patients that require transfusion for these causes, whether admitted to the emergency room or the operating room, or during the postoperative period.

S00-S09	Injuries to the head
S10-S19	Injuries to the neck
S20-S99	Injuries to the thorax; abdomen, lower back, lumbar spine and pelvis; shoulder and upper arm; elbow and forearm; wrist and hand; hip and thigh; knee and lower leg; and ankle and foot
T20-T32	Burns and corrosions
T33-T50	Frostbite. Poisoining by drugs, medicaments and biological substances

Orthopedics

This includes the following diseases of the musculoskeletal system and connective tissue that require surgical interventions and transfusions.

M16	Coxarthrosis (arthrosis of hip)
M17	Gonarthrosis (arthrosis of knee)
M41	Scoliosis
M05	Seropositive rheumatoid arthritis
M80	Osteoporosis with pathological fracture
Q65	Congenital deformities of hip

General surgery

Comprises all patients in the “Clinical conditions” group when undergoing a surgical intervention. The proposed model requires that only the need for transfusion in the operating room or within 48 hours of the day of surgery should be taken into account.

Obstetric and gynecological conditions

Obstetrics

This group includes patients that require blood for obstetric or gynecological causes, including clinical as well as surgical causes.

O00-O08	Pregnancy with abortive outcome
020-025	Other maternal disorders predominantly related to pregnancy
O72	Postpartum haemorrhage
045	Premature separation of placenta

Gynecology

This group includes inflammatory and noninflammatory pelvic diseases of the female genital organs. For these diseases, only the ICD-10 related to other abnormal uterine and vaginal bleeding (N93) and habitual aborters (N96) may require transfusions when they are associated with acute hemorrhages involving more than 30% of blood volume.

Neonatal conditions

P00-P04	Fetus and newborn affected by maternal factors and by complications of pregnancy, labour and delivery
P07	Disorders related to short gestation and low birth weight, not elsewhere classified
P35-P39	Infections specific to the perinatal period
P50-P61	Haemorrhagic and haematological disorders of fetus and newborn
P77	Necrotizing enterocolitis of fetus and newborn
Q20-Q28	Congenital malformations of the circulatory system

Additional factors

In the data required to calculate the need for blood and blood components at the hospital level, it is essential to record whether, during the course of the study, the expected medical or surgical care was not provided to patients due to a lack of blood and the medical conditions of those patients, and the number of cases of individuals either not treated appropriately or whose treatment was postponed because the necessary blood component was unavailable. In order to determine the actual need for blood and blood components at the hospital level, the unmet needs should be added to the number of units that were transfused. The estimates and projections should also take future increases in the capacity of the health care system into account, including the addition of services such as cardiovascular surgery (CVS) or tissue and organ transplants, and extension of the coverage of programs to treat cardiac malformations in the pediatric population.

To calculate the need for blood and blood components in an entire jurisdiction or country, in addition to the results from all local public and private institutions, the projected population growth, increases in life expectancy, and the expansion of coverage of new medical technologies should be considered. Moreover, in order to provide enough blood for unanticipated situations such as disasters, pandemics, and mass emergency vaccination campaigns for adults, 4% should always be added to the figures from the total estimates of the amount of blood needed for one year, The blood services that supply blood components to hospitals should be familiar with these scenarios, so that they can adjust the number of units of blood to collect in a given period.

> Information from the hospitals should be consolidated and analyzed by the respective blood programs at the provincial, state, regional, and national levels in order to determine the costs of the system, determine and allocate the resources required, and evaluate the achievement of goals and objectives. The health authorities should consider whether administrative and regulatory changes in the national blood system may be warranted to meet the future need for blood components in hospitals.

General considerations

The sources used to calculate the need for blood and blood components usually differ in terms of the scope and quality of the data. In some instances, reports include only 90% of the transfusions performed in a population (108). In other cases where care is also provided for patients from other jurisdictions, estimates based on the number of inhabitants do not yield useful results, unless the patients from other jurisdictions can be excluded from the calculation, as in Funen. Fortunately, the main purpose of the needs estimate is to determine whether the patients that visit the hospital will have the blood component required for their care, regardless of where they live.

A typical case is the public hospitals in the city of Buenos Aires. As stated earlier, these hospitals provide care not only for the population of CABA (estimated at slightly over 3 million) but for nearly the same number of persons from outside the city (105). The same holds true in other Latin American countries, since with a few exceptions, high-complexity health care is concentrated in the public and private hospitals of the major cities.

Table 6 shows the comparative data for northern England (92), Funen in Denmark (99), and Misiones in Argentina (108) using different classification models. The ICD-10 differentiates between diseases but does not distinguish between clinical and surgical conditions. It can be seen that two columns refer to the probability that a clinical condition or group of conditions or interventions may require transfusions of PRBC.

TABLE 6. Estimated use of PRBC according to the International Classification of Diseases, ICD-10 [a]

ICD-10	Diseases	Misiones Use of PRBC by total Tx RBC (%)	Northern England Use of PRBC by total Tx RBC (%) [b]	Argentina Patients that require Tx by condition and evaluation of needs (%) [c]	Average UPRBC used per condition/ patient	Denmark Use of PRBC based on ICD-10/Total Tx RBC [d]
C00-D48 C81-C96	Neoplasms[e]	+		41.81[f]	24.85[g]	25.5
K00-K93	Hemorrhage of the digestive system	+		41.0[h]	6.74[i]	15.5
D50-D89	Diseases of the blood and blood-forming organs and immune disorders [j]	+		53.72	35.82[k]	11.1
Z00-Z99	Factors influencing health status and contact with health services [l]	+		N/A	Included in previous category	3.6
N00-N99	Diseases of the genitourinary system [m]	+		N/A	Included in previous category	3.2
R00-R99	Symptoms, signs, and abnormal laboratory findings [n]	+		N/A	Included in previous category	3.3
J00-J99 A00-B99 E00-E90 L00-L99 G00-G99 F00-F99	Diseases of the respiratory system [o]; parasitic, endocrine, skin, nervous system, and psychiatric conditions			N/A	Included in previous category	Sum of percentage use for ICD-10 8.2
Total clinical indications		**42.45**	**51.0**		**67.41**	

TABLE 6. *continued*

ICD-10	Diseases	Misiones Use of PRBC by total Tx RBC (%)	Northern England Use of PRBC by total Tx RBC (%) [b]	Argentina Patients that require Tx by condition and evaluation of needs (%) [c]	Average UPRBC used per condition/ patient	Denmark Use of PRBC based on ICD-10/Total Tx RBC [d]
I00-I99	Diseases of the cardiovascular system [p]	+		70.0	10.60	14.5
S00-T98	Injury, poisoning, and other consequences of external causes	+		40.94	9.06	9.7
M00-M99	Diseases of the musculoskeletal system and connective tissue (including orthopedics)			30.30	7.98	3.5
Total surgical indications		**37.80**	**40.7**		**27.64**	
O00-O99	Pregnancy, childbirth, and the puerperium	11.58	6.3	20.35[q]	1.48	1.5
P00-P96 Q00-Q99	Certain conditions originating in the perinatal period and congenital malformations [r]	6.84 (neo + other pediatric = 9)	0.6	37.57[s]	3.52	0.4

TABLE 6. ***continued***

[a] *International Classification of Diseases.*
[b] *The data represents 98.6% of UPRBC, since the clinical details of 1.4% of the units were not reported.*
[c] *See specific table.*
[d] *In the case of Funen, the ICD-10 classifications may include clinical and surgical indications.*
[e] *C00-D48, solid benign and malignant tumors; C81-C96, lymphomas and leukemias.*
[f] *The percentages of transfusions for oncology/hematology and solid tumors were added.*
[g] *The figures for solid tumors, leukemia and lymphomas were added.*
[h] *The percentages of transfusions for clinical and surgical gastrointestinal bleeding were added.*
[i] *The cases of general surgery were added.*
[j] *D50-D53, nutrient-deficiency anemia; D55-D59, hemolytic anemia; D60-D64, aplastic and other anemias; D70-D77, coagulation defects, purpura, other blood diseases; D80-D89, immune disorders.*
[k] *Chronic anemia associated with other diseases is included.*
[l] *Z00-Z99, persons with potential health risks and social or infectious problems.*
[m] *N90-N99, diseases of the male genitals, female genitals, and kidney diseases.*
[n] *Includes the symptoms and findings of different bodily systems not otherwise classified (e.g., hemoptysis, R04.2.).*
[o] *J00-J99, diseases of the respiratory system, including radiant, aspiration, and toxic pneumonitis.*
[p] *I80-I89, esophageal varices, hemorrhoids, thrombophlebitis, Budd Chiari syndrome, and other diseases; I05-I09, valve diseases; I20-I25, ischemic diseases; I71, aneurysms.*
[q] *This group included gynecological diseases (cancer, myomas).*
[r] *P00-P96, Q00-Q99. In Misiones the figure includes the pediatric transfusions.*
[s] *One year's data from a high-complexity hospital that uses restrictive guidelines (personal communication, del Pozo A.).*

Demand for blood components for surgery at the hospital level

> The method proposed by Friedman, the "maximum surgical blood order schedule," is still useful for calculating the demand for blood components for surgery. In short, this method recommends that each hospital regularly calculate its demand, based on the use of blood components in each surgical intervention (109, 110).

However, considering the variables already described in this document, as well as the distribution of the blood groups among the patients, many hospitals in the United States no longer use this method because they conduct electronic compatibility tests and therefore do not predetermine the number of units for each patient. Nevertheless, although the Friedman method (109) would not be suitable for estimating the community need for blood and blood components, in other countries of the Region of the Americas, it could be appropriate for calculating the surgical demand for blood at the hospital level.

Maternal mortality: a key factor

Maternal mortality ratios, which are influenced by the quality of health care during pregnancy, childbirth, and the puerperium, vary among the Latin American and Caribbean countries (Table 7). Maternal mortality ratios and the proportion of maternal death rates associated with hemorrhage can be used to evaluate the availability and timely access to specialized care, including blood transfusions (95).

The maternal mortality ratios reported by the United Kingdom (1 per 100,000 live births), Australia (4.3), and Denmark (8.0), are significantly lower than those in Latin America and the Caribbean. For example, in 2007 there were 39.2 maternal deaths per 100,000 live births in Argentina, 86.5 in Nicaragua, and 153.5 in Paraguay (111-114). However, these figures do not reflect the fact that maternal deaths may be much higher in some areas of the countries, as is the case in Argentina's Misiones province, where the ratio in 2006 was 125 per 100,000 live births (115). These differences underscore the critical importance of knowing the risk of hemorrhagic complications of delivery in each institution and the maternal mortality rate in each country and jurisdiction (116).

TABLE 7. Rates of blood donation, donors with infectious markers, blood availability, maternal mortality and maternal deaths from hemorrhage in Latin America and the Caribbean, 2003

Country	Blood donations (per 10,000 inhabitants)	Infectious markers (%)	Availability of blood (per 10,000 inhabitants)	Mortality (per 100,000 live births)	Deaths from hemorrhage (%)
Cuba	521.3	3.07	505.28	41.8	1.050
Uruguay	291.9	1.97	286.15	11.1	NA
Curacao	274.4	0.11	274.10	32.0[a]	NA
Argentina	203.1	6.85	189.19	43.5	10.498
Antigua and Barbuda	182.1	1.20	181.10	65.4[a]	NA
Brazil	164.3	3.03	159.32	44.9	NA
Bahamas	163.5	3.70	157.45	38.0[a]	NA
Panama	148.0	1.45	145.85	71.3	NA
Suriname	143.1	0.33	142.63	153.0[a]	39.062
Venezuela	133.3	3,56	128.55	67.2	15.982
Costa Rica	116.5	2.49	113.60	38.0	NA
El Salvador	166.9	4.68	111.43	120.0	NA
Saint Lucia	110.9	1.50	109.24	34.7[a]	NA
Chile	109.9	0.68	109.15	18.7	6.349
Belize	112.6	3.40	108.77	68.4[a]	NA
Colombia	111.9	2.94	108.61	104.9	NA
Mexico	109.8	2.05	107.55	76.9	7.891
Saint Kitts and Nevis	100.0	5.22	94.78	246.6[a]	NA
Jamaica	98.4	7.29	91.23	106.2	NA
Dominican Republic	88.2	2.97	85.58	82.0	10.959
Nicaragua	85.2	3.66	82.09	97.0	NA
Paraguay	87.0	10.42	77.93	160.7	22.641
Honduras	70.3	4.10	67.42	108.0	46.871
Ecuador	60.9	5.04	57.83	97.0	NA
Guyana	59.1	4.30	56.56	133.3[a]	NA
Guatemala	55.6	5.28	52.66	153.0	NA
Peru	53.6	3.86	51.53	185.0	39.504
Bolivia	43.8	6.79	40.82	390.0	NA
Haiti	10.4	9.06	9.46	523.0	NA

[a] *Data for 2002.*

Source: Taken from reference 95.

In Australia, although the general rate of complications of delivery was 13.8 per 1,000 births, the rate of peripartum hemorrhages (PPH) in the first pregnancy was 5.8% (7,327/125,295) and the risk of recurrence in the second pregnancy was 14.8% (1,082/7,327). In the third pregnancy, the risk was 21.7% (43/198) in patients with a history of PPH and 10.2% (111/1,085) in patients without previous PPH (111, 112). This information demonstrates the importance of recording the age and sex of the patients who receive transfusions when estimating the future need for blood components.

Other clinico-epidemiological considerations

Several countries in the Region of the Americas have risk factors for transfusions, including some parasitic infections, adolescent pregnancies, and nutrient-deficiency anemia, that are not present in more developed countries, although nutrient-deficiency anemia does not justify the transfusion of PRBC, it increases its likelihood. It is also important to bear in mind that infection with the human immunodeficiency virus increases the probability of developing lymphomas and, consequently, the transfusion requirements that accompany the treatment of such conditions (117). To a similar extent, outbreaks of emerging infectious agents, such as dengue or other arboviruses, can result in seasonal increases in the need for blood components.

OPERATIONAL PROCEDURE FOR ESTIMATING NEEDS

Responsible entities

The National Blood Program is responsible for implementing the blood policy and blood plan; for defining the need for blood components and annual collection goals; for collecting, validating, and analyzing national data; disseminating information; and for monitoring the technical, scientific, medical, and administrative capacity of the blood services (118).

The National Committees for the Clinical Use of Blood are responsible for good transfusion practices through the creation, review, updating, and circulation of clinical guidelines that ensure the appropriate use of blood and blood components. The National Committee's role includes defining procedures for the creation and operation of Regional and Hospital Committees for the Clinical Use of Blood, promoting the education and training of the staff involved in prescribing and administering blood, promoting the collection and analysis of data provided by the regional bodies to facilitate hemovigilance, promoting clinical studies on the use of blood, and comparing regional and national use indicators (119).

In the case of the Regional Committees for the Clinical Use of Blood, in addition to monitoring hospital implementation of the procedures established by the National Committee, they are responsible for preparing the work plan in keeping with regional resources; promoting the creation of Hospital Committees; coordinating work between Hospital Committees to ensure more efficient and effective use of blood in the regional area, and ensuring that up-to-date hospital data is available, especially on transfusion practices and the clinical impact of transfusions (119).

The Hospital Committees for the Clinical Use of Blood are responsible for determining the specific need for blood and blood components and ensuring an appropriate supply in their respective hospitals, for developing transfusion protocols, preventing loss and wastage of blood components, and developing adequate documentation of transfusion practices (119).

Preparatory phase

The National Blood Program is responsible for defining geographic regions and/or institutions of the national blood system and identifying the hospitals where the need for blood and blood components will be estimated, based on the country's geographic and administrative units. The National Blood Program is also responsible for identifying the person responsible for consolidating the information from each geographic area and institution. Furthermore, it determines the subdivisions (public sector, Social Security, private sector) of the geographical areas in which the need for blood components for each jurisdiction will be consolidated and designates the staff responsible for handling the information in each subdivision.

In addition, in coordination with the National Committee for the Clinical Use of Blood, the National Blood Program develops the procedures and instruments for the collection, review, and quality control of the data on the use of blood components, and for data analysis, validation, and dissemination to each geographic area, institution, subdivision, sector, and hospital.

The National Blood Program establishes the precise period for data collection and the timetable for its validation, analyses, and publication. The timetable of the exercise will depend on the experience of the staff and the areas to be covered. Consideration of the following stages is recommended: a) planning; b) development of processes and instruments; c) staff training; d) data collection; e) data organization and processing; f) data analysis; g) calculation of needs; and h) preparation of reports (120).

It is very important that the staff responsible for filling out the matrix on the use of blood and blood components in each hospital receive appropriate training and fully understand why the information is being collected. Before beginning their duties, this staff should know or familiarize itself with data processing to achieve proper standardization of data entry.

Operational phase

For the review of medical histories and data collection at the hospital level, the matrix for applying the model for calculating needs will be used (Annex B), and patients will be classified into four groups: a) clinical conditions; b) surgical interventions; c) obstetric-gynecologic conditions; and d) conditions of the neonatal period.

Creation of an initial database that includes the following points is recommended:

A. Patient data:
   1. First and last names
   2. Identity document number
   3. Patient number or alphanumeric code
   4. Date of admission
   5. Date of birth and age
   6. Sex
   7. Location in the hospital (e.g., department, sector, ward)
   8. Clinical diagnosis and International Classification of Diseases (ICD-10) code

9. Clinical situation that justifies the transfusion. Indicating "anemia" is considered inappropriate. It is recommended that the condition that led to the need for the transfusion be specified (e.g., upper digestive bleeding, metrorrhagia, peripartum hemorrhage, severe epistaxis, aregenerative or aplastic anemia, hemorrhage associated with polytrauma or mechanical hemolytic anemia).
10. Categorization as clinical, surgical, obstetric-gynecological, or neonatal patient
11. Date, type, and amount of blood components administered

B. Transfusions not given or postponed due to lack of blood components

C. Surgical interventions cancelled or postponed due to lack of blood components

This database will be used to complete the matrix for application of the model so that the total number of patients admitted to the hospital, the number of patients with clinical conditions, the number of patients subject to surgical interventions, the number of obstetric/gynecology patients, and the number of neonates that receive care are known. In each of these patient categories, the number of patients that receive care will be indicated by clinical diagnosis and the number and percentage of patients that receive transfusions will be identified. Transfusion recipients will be grouped by clinical diagnosis, sex, and age group. The number of units of the blood component used for each clinical diagnosis will also have to be recorded by the age and sex of the patients. The average number of units of the blood component will be calculated for each patient, dividing the total units used by the total number of patients that receive transfusions. It is recommended that tables be prepared summarizing the total number of patients admitted to the hospital, the number of patients that receive transfusions, the number of units of blood components administered and the number of units of blood components administered to each patient, as shown in the summary of the matrix in Annex B.

The Hospital Transfusion Committee for the Clinical Use of Blood will be responsible for reviewing the matrix and data consolidation tables in order to determine the use of blood components during the time period reviewed, which is recommended to be 12 consecutive months. Based on the distribution of the clinical conditions, the number of units administered per patient in each diagnostic group, and the number of transfusions and interventions postponed, the unmet hospital demand will be estimated so that the real need for blood components during the period reviewed can then be determined.

Each hospital will send the completed matrix to the responsible parties at the geographical jurisdiction or administrative sector levels (i.e., public, Social Security, private), following the procedures established by the national blood program. The need for blood components by jurisdiction and sector for the next period will be estimated at these levels. In these calculations, the health authorities of the jurisdiction should consider whether actions have been programmed that will affect the need for blood components in the immediate future, so that adjustments can be made that include this cumulative demand.

After the geographical jurisdictions or administrative sectors send their matrices of blood needs to the regional authorities, the estimated need is planned at the regional level. Here, in coordination with the Regional Transfusion Committee for the Clinical Use of Blood, the data received for the Region as a whole is consolidated in a new document.

In the next step of the procedures, the regional authorities will submit a summary of the estimated need for blood by their populations to the national blood program. The program, in coordination with the National Committee for the Clinical Use of Blood, will consolidate all of the information received to estimate the country need for blood components. It should be noted that for packed red blood cells, 4% should be added to the estimated total to cover unforeseen emergency situations. In the final phase of the procedure, the national blood program will inform the health authorities and the media about the estimated blood requirements, as well as the mechanisms that will be used to deliver blood to hospitals.

Monitoring and evaluation

The National Blood Program and the National Committees for the Clinical Use of Blood will manage the ongoing evaluation of the method and conditions in which hospitals receive shipments of blood components, as well as efficiency in the use of such products vis-à-vis needs. At the hospital level, the Hospital Committee for the Clinical Use of Blood will be responsible for monitoring and documenting the impact of transfusions on patient health. The information obtained will be used by transfusion committees at the hospital, regional, and national levels in order to adjust clinical practice guidelines and the estimated need for blood components.

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ANNEXES

Calculating the need for blood and blood components requires knowledge of transfusion practices for the clinical, surgical, obstetric-gynecological, and neonatal conditions for which care is provided in each public and private hospital in the geographical area studied. A percentage should be added to the result of this estimate for the impact of the implementation of new technologies and the expansion of health coverage of the population, as well as a 4% reserve for emergencies, epidemics, vaccination campaigns, or natural disasters.

In order to assist the countries in obtaining more accurate forecasts of the need for blood, the resolution in which the PAHO Directing Council urges the countries to calculate the need for blood (Annex A), the matrix recommended by the Organization to document the hospital transfusion practices (Annex B), and hypothetical examples of application of this instrument according to whether the need is associated with a clinical condition, surgical intervention, obstetric-gynecological condition, or conditions originating in the neonatal period (Annex C) are shown below. The data included in the hypothetical examples is based on the experience of Hospital de Pediatría Prof. Dr. Juan P. Garrahan of Buenos Aires, Argentina and the article by Maxwell EL, Metz J, Haeusler MN, Savoia HF, Use of red blood cell transfusions in surgery, ANZ J Surg 2002; 72:561-6. Finally, the results of the validation process for the model proposed by PAHO, which was conducted in Nicaragua with the participation of 20 specialists from nine hospitals in the country, are described in Annex D.

ANNEX A

Resolution CD48.R7 of the Directing Council of PAHO

PAN AMERICAN HEALTH ORGANIZATION
WORLD HEALTH ORGANIZATION

48th DIRECTING COUNCIL
60th SESSION OF THE REGIONAL COMMITTEE

Washington, D.C., USA, 29 September-3 October 2008

CD48.R7 (Eng.)
ORIGINAL: ENGLISH

RESOLUTION

CD48.R7

IMPROVING BLOOD AVAILABILITY AND TRANSFUSION SAFETY IN THE AMERICAS

THE 48th DIRECTING COUNCIL,

Having considered the report of the Director on blood transfusion safety (Document CD48/11), which summarizes the difficulties observed in the implementation of the Regional Plan of Action for Transfusion Safety 2006-2010;

Aware of the central role that transfusions play in the appropriate medical care of patients and in the reduction of mortality among mothers, infants, victims of traffic accidents and other traumas, patients suffering from cancer or clotting disorders, and transplant patients;

Concerned that the current levels of availability and safety of blood for transfusion in the Region are unsatisfactory;

Recognizing that the current national organizational systems limit the efficacy of blood transfusions, have negative effects on morbidity and mortality, and result in major financial losses;

Considering that the concepts of Resolutions CD41.R15 (1999) and CD46.R5 (2005) still apply to the Region of the Americas, and that action is required by national authorities to implement the strategies of the Regional Plan of Action 2006-2010, approved by the 46th Directing Council; and

Recognizing that modifications in current national approaches are needed in order to achieve the regional goals set for transfusion safety by 2010,

RESOLVES:

1. To urge Member States to:

(a) proactively implement the Regional Plan of Action for Transfusion Safety 2006-2010 by:

i. defining a specific entity within the normative level of their ministries of health as responsible for the planning, oversight and overall efficient operation of the national blood system;

ii. estimating the annual national need for blood components, taking into consideration unforeseen emergencies, expected increases of the general and elderly population, social inclusion of currently excluded populations, road traffic injuries, and local adoption of medical technologies, such as transplants and cancer treatment, and the financial resources necessary to cover those needs;

iii. establishing a network of volunteers to educate the community and to promote voluntary blood donation and service blood donors, with special attention to youth programs;

(b) except in limited circumstances of emergency medical necessity, terminate replacement and paid blood donation by the end of 2010, with a goal of 100% voluntary, altruistic, non-remunerated blood donation, using the information obtained from socio-anthropological surveys conducted in the countries, given that blood collection should not be solely the responsibility of hospital medical teams;

(c) terminate mandatory patient replacement of transfused blood by the end of 2010;

(d) share best practices in the recruitment and retention of voluntary blood donors.

2. To request the Director to:

(a) cooperate with the Member States in the implementation of the Regional Plan of Action for Transfusion Safety 2006-2010 using a multidisciplinary and coordinated approach for health promotion, public education, human and patient rights, quality assurance and financial efficiency;

(b) work with Member States and international organizations to assess the implementation of the Regional Plan of Action 2006-2010 and to identify country-specific interventions needed to assure sufficiency and acceptable quality and safety of blood for transfusions at the national level;

(c) prepare annual reports on the situation of blood transfusion safety in the Region.

(Seventh meeting, 2 October 2008)

ANNEX B

Matrix to Estimate the Needs for Blood and Blood Components

Matrix to Estimate the Needs for Blood and Blood Components

International Classification of Diseases (ICD-10) code	Diseases according to etiology or system	ICD-10 diagnosis and number of patients admitted	Total patients admitted	Number of transfusion recipients (percentage)	Number of transfusion recipients / Number of UPRBC used								Total UPRBC used (units/ patient)	Guidelines for appropriate use of transfusions
					Sex		Age groups (years)							
					F	M	<1	1-4	5-14	15- 44	45-64	> 65		
	I. Clinical conditions													
	II. Surgical interventions													
	III. Obstetric-gynecological conditions													
	IV. Conditions of the neonatal period													

ANNEX C

Hypothetical Example to Estimate the Needs for Blood and Blood Components

Hypothetical Example to Estimate the Needs for Blood and Blood Components

I. Clinical conditions

International Classification of Diseases code (ICD-10)	Diseases according to etiology or system	ICD-10 diagnosis and number of patients admitted	Total patients admitted	Number of transfusion recipients (percentage)	Number of transfusion recipients / Number of UPRBC used								Total UPRBC used (units/ patient)	Guidelines for appropriate use of transfusions
					Sex		Age groups (years)							
					F	M	<1	1-4	5-14	15- 44	45-64	> 65		
C00-D48 C81-C96	Neoplasms		126	37 (29.4)	20	17		2	6	13	15	1		Chronic critical and acute patients (cancer, respiratory disease, cerebrovascular disease) If Hb is: >10g/dL: Tx is not indicated (recommendation grade 1A similar to level of evidence I) >7 and <10g/dL: Tx can be indicated but there should be rationale (recommendation grade 1B similar to level of evidence II-III) <7g/dL: Tx may be appropriate (recommendation grade 1C similar to level of evidence III-IV) Cardiovascular disease/ischemia patients Stable: can be managed with Hb 6-7g/dL Symptomatic: manage with 9Hb-10g/dL (recommendation grade 1B similar to level of evidence III-IV)
					116	98		11	46	84	71	2	214 (5.78)	
		C91 Acute lymphoblastic leukemia N=10		5 (50)	3	2		1	2	1	1			
					40	18		3	18	15	22		58 (11.60)	
		C92 Acute myeloblastic leukemia N=4		4 (100)	2	2		1	1	2				
					34	28		8	17	37			62 (15.50)	

International Classification of Diseases code (ICD-10)	Diseases according to etiology or system	ICD-10 diagnosis and number of patients admitted	Total patients admitted	Number of transfusion recipients (percentage)	Number of transfusion recipients / Number of UPRBC used								Total UPRBC used (units/ patient)	Guidelines for appropriate use of transfusions
					Sex		Age Groups (years)							
					F	M	<1	1-4	5-14	15- 44	45-64	> 65		
		C82-C84 Non-Hodgkin's lymphoma N=6		4 (66.7)	1	3			1	1	2			
					11	24			7	11	17		35 (8.75)	
		C81 Hodgkin's disease N=1		1 (100)	1					1				Hypoproliferative anemia Background treatment and transfusion when there is cardiorespiratory compromise Thalassemia major Transfuse with Hb 9 to 10g/dL Increase to Hb 12g/dL (recommendation grade 1B similar to level of evidence I-II). Use iron chelating agents Radiation Maintain levels of Hb 10-12g/dL (recommendation grade 2B) Chemotherapy Maintain levels of Hb 8-10g/dL (recommendation grade 2 B similar to level of evidence IV)
					4					4			4 (4.00)	
		C50 Breast cancer N=26		2 (7.7)	2					1	1			
					2					1	1		2 (1.00)	
		C34 Lung cancer N=16		4 (25)	2	2				2	2			
					6	6				5	7		12 (3.00)	

International Classification of Diseases code (ICD-10)	Diseases according to etiology or system	ICD-10 diagnosis and number of patients admitted	Total patients admitted	Number of transfusion recipients (percentage)	Number of transfusion recipients / Number of UPRBC used								Total UPRBC used (units/ patient)	Guidelines for appropriate use of transfusions
					Sex		Age group (years)							
					F	M	<1	1-4	5-14	15- 44	45-64	> 65		
		C61 Prostate cancer N=10		1 (10)		1				1				
						3				3			3 (3.00)	
		C55 Uterine cancer N=10		1 (10)	1						1			
					2						2		2 (2.00)	
		C56 Ovarian cancer N=7		2 (28.6)	2					1	1			
					4					1	3		4 (2.00)	
		C25 Pancreatic cancer N=7		2 (28.6)	1	1				1	1			
					2	4				4	2		6 (2.50)	

International Classification of Diseases code (ICD-10)	Diseases according to etiology or system	ICD-10 diagnosis and number of patients admitted	Total patients admitted	Number of transfusion recipients (percentage)	Number of transfusion recipients / Number of UPRBC used								Total UPRBC used (units/ patient)	Guidelines for appropriate use of transfusions
					Sexo=		Age group (years)							
					F	M	<1	1-4	5-14	15- 44	45-64	> 65		
		C43 Melanoma with metastasis N=3		2 (66.7)	1	1				1	1			
					1	2				2	1		3 (1.50)	
		C16 Stomach cancer N=4		2 (50)		2					2			
						7					7		7 (3.50)	
		C15 Esophageal cancer N=2		1 (50)	1						1			
					4						4		4 (4.00)	
		C71 Brain tumor N=4		1 (25)	1				1					
					2				2				2 (2.00)	

International Classification of Diseases code (ICD-10)	Diseases according to etiology or system	ICD-10 diagnosis and number of patients admitted	Total patients admitted	Number of transfusion recipients (percentage)	Number of transfusion recipients / Number of UPRBC used								Total UPRBC used (units/ patient)	Guidelines for appropriate use of transfusions
					Sex		Age group (yearsO							
					F	M	<1	1-4	5-14	15- 44	45-64	> 65		
		C40.2 Bone sarcomas N=3		1 (33.3)	1					1				
					1					1			1 (1.00)	
		C22 Hepatomas N=4		3 (75)	1	2			1		2			
					3	4			2		5		7 (2.33)	
		C18 Colon cancer N=9		1 (11.1)		1						1		
						2						2	2 (2.00)	

International Classification of Diseases code (ICD-10)	Diseases according to etiology or system	ICD-10 diagnosis and number of patients admitted	Total patients admitted	Number of transfusion recipients (percentage)	Number of transfusion recipients / Number of UPRBC used								Total UPRBC used (units/ patient)	Guidelines for appropriate use of transfusions
					Sex		Age group (years)							
					F	M	<1	1-4	5-14	15- 44	45-64	> 65		
K00-K93	Hemorrhages of the digestive system		284	167 (58.8)	80	87		17	19	42	47	42		
					181	249		22	34	90	136	148	430 (2.57)	
		K29 Gastritis N=71		22 (31)	10	12			6	5	4	7		If Hb is: >10 g/dL: Tx is not indicated (recommendation grade 1A similar to level of evidence I)
					22	29			8	10	12	21	51 (2.32)	>7 and <10 g/dL: Tx can be indicated but there should be rationale (recommendation grade 1 B similar to level of evidence II-III)
		K29 Duodenitis N=64		21 (32.8)	12	9				6	8	7		< 7g/dL: Tx may be appropriate (recommendation grade 1C similar to level of evidence III-IV)
					39	19				14	20	24	58 (2.76)	Cardiovascular diseases/ ischemia
		K52, A08.2 Gastroenteritis N=24		18 (75)	10	8		8	2	1	1	6		Stable: can be managed with Hb 6-7g/dL
					14	18		8	3	1	2	18	32 (1.78)	Symptomatic: manage with Hb 9-10g/dL (recommendation grade 1B similar to level of evidence III-IV)

International Classification of Diseases code (ICD-10)	Diseases according to etiology or system	ICD-10 diagnosis and number of patients admitted	Total patients admitted	Number of transfusion recipients (percentage)	Number of transfusion recipients / Number of UPRBC used								Total UPRBC used (units/ patient)	Guidelines for appropriate use of transfusions
					Sex		Age group (years)							
					F	M	<1	1-4	5-14	15- 44	45-64	> 65		
		To 04.8 Enterocolitis N=29		19 (65.5)	12	7		8	4	2	1	4		
					21	16		12	6	3	1	15	37 (1.95)	
		I84.1 Rectal hemorrhage (hemorrhoids) N=9		8 (88.9)	5	3				4	3	1		
					5	5				4	5	1	10 (1.25)	
		K25 Stomach ulcer N=11		10 (90.9)	4	6			1	4	3	2		
					7	12			1	5	6	7	19 (1.90)	
		K26 Duodenal ulcer N=9		8 (88.9)	3	5				2	4	2		
					4	13				3	8	6	17 (2.13)	

International Classification of Diseases code (ICD-10)	Diseases according to etiology or system	ICD-10 diagnosis and number of patients admitted	Total patients admitted	Number of transfusion recipients (percentage)	Number of transfusion recipients / Number of UPRBC used								Total UPRBC used (units/ patient)	Guidelines for appropriate use of transfusions
					Sex		Age group (years)							
					F	M	<1	1-4	5-14	15- 44	45-64	> 65		
		K50 Crohn's disease N=1		1 (100)		1			1					
						1			1				1 (1.00)	
		I85.0 Esophageal varices N=17		17 (100)	4	13			3	4	7	3		
					17	67			10	16	36	22	84 (4.94)	
		K70, K74.3, K71 Cirrhosis N=20		20 (100)	9	11		1	2	6	7	4		
					33	43		2	5	21	29	19	76 (3.80)	
		K85 Pancreatitis N=10		9 (90)	4	5				5	3	1		
					8	16				8	8	8	24 (2.67)	

International Classification of Diseases code (ICD-10)	Diseases according to etiology or system	ICD-10 diagnosis and number of patients admitted	Total patients admitted	Number of transfusion recipients (percentage)	Number of transfusion recipients / Number of UPRBC used								Total UPRBC used (units/ patient)	Guidelines for appropriate use of transfusions
					Sex		Age group (years)							
					F	M	<1	1-4	5-14	15- 44	45-64	> 65		
		K7.2 Perforation of diverticulum of the colon N=2		2 (100)	1	1				1	1			
					3	2				3	2		5 (2.50)	
		K56.2 Intestinal occlusion associated with volvulus N=9		9 (100)	4	5				2	4	3		
					6	7				2	6	5	13 (1.44)	
		K81 Cholecystitis N=3		1 (33.3)	1							1		
					1							1	1 (1.00)	
		K83.1 Cholangitis N=3		1 (33.3)		1					1			
						1					1		1 (1.00)	

International Classification of Diseases code (ICD-10)	Diseases according to etiology or system	ICD-10 diagnosis and number of patients admitted	Total patients admitted	Number of transfusion recipients (percentage)	Number of transfusion recipients / Number of UPRBC used								Total UPRBC used (units/ patient)	Guidelines for appropriate use of transfusions
					Sex		Age group (years)							
					F	M	<1	1-4	5-14	15- 44	45-64	> 65		
		K82 Gallbladder obstruction N=2		1 (50)	1							1		
					1							1	1 (1.00)	

International Classification of Diseases code (ICD-10)	Diseases according to etiology or system	ICD-10 diagnosis and number of patients admitted	Total patients admitted	Number of transfusion recipients (percentage)	Number of transfusion recipients / Number of UPRBC used								Total UPRBC used (units/ patient)	Guidelines for appropriate use of transfusions
					Sex		Age group (years)							
					F	M	<1	1-4	5-14	15- 44	45-64	> 65		
D50-D89	Diseases of the blood and blood-forming organs and immune disorders		677	226 (33.4)	161	65	11	20	49	53	49	44		
					1112	674	31	106	335	651	416	247	1786 (7.90)	
		R00-R99 Asymptomatic anemia N=273		0										
													0	
		D50-D53 Anemia associated with other diseases (kidney disease, malnutrition, infection) N=369		193 (52.3)	143	50	9	19	44	37	41	43		
					691	216	25	64	199	169	208	242	907 (4.70)	
		D61.9 Aplasia N=5		5 (100)	3	2		1	2	2				
					121	66		42	69	76			187 (37.40)	

International Classification of Diseases code (ICD-10)	Diseases according to etiology or system	ICD-10 diagnosis and number of patients admitted	Total patients admitted	Number of transfusion recipients (percentage)	Number of transfusion recipients / Number of UPRBC used								Total UPRBC used (units/ patient)	Guidelines for appropriate use of transfusions
					Sex		Age group (years)							
					F	M	<1	1-4	5-14	15- 44	45-64	> 65		
		D56 Thalassemia N=8		8 (100)	3	5	1		1	3	3			
					209	338	2		48	317	180		547 (68.38)	
		D57 Sickle cell anemia with crisis N=5		5 (100)	2	3			1	4				
					15	20			9	26			35 (7.00)	
		D59 Acquired hemolytic anemia N=9		9 (100)	5	4	1		1	4	3			
					34	31	4		10	29	22		65 (7.22)	
		D51 Pernicious anemia N=1		1 (100)	1							1		
					5							5	5 (5.00)	

International Classification of Diseases code (ICD-10)	Diseases according to etiology or system	ICD-10 diagnosis and number of patients admitted	Total patients admitted	Number of transfusion recipients (percentage)	Number of transfusion recipients / Number of UPRBC used								Total UPRBC used (units/ patient)	Guidelines for appropriate use of transfusions
					Sex		Age group (years)							
					F	M	<1	1-4	5-14	15- 44	45-64	> 65		
		D68 Von Willebrand's disease N=2		2 (100)	2					2				
					26					26			26 (13.00)	
		I80.1 Deep venous thrombosis N=4		2 (50)	1	1					2			
					3	3					6		6 (3.00)	
		M31.1 Thrombotic thrombocy-topenic purpura N=1		1 (100)	1					1				
					8					8			8 (8.00)	

II. Surgical interventions

International Classification of Diseases code (ICD-10)	Diseases according to etiology or system	ICD-10 diagnosis and number of patients admitted	Total patients admitted	Number of transfusion recipients (percentage)	Number of transfusion recipients / Number of UPRBC used								Total UPRBC used (units/ patient)	Guidelines for appropriate use of transfusions
					Sex		Age group (years)							
					F	M	<1	1-4	5-14	15- 44	45-64	> 65		
I00-I99	Interventions in diseases of the circulatory system		173	104 (69.1)	43	61				16	74	14		
					121	192				43	212	58	313 (3.01)	
		I21.9 Stent placement N=24		1 (4.1)		1					1			If Hb is: >10: Tx is not indicated (recommendation grade 1A similar to level of evidence I) >7 and <10g/dL: Tx can be indicated but there should be rationale (recommendation grade 1B similar to level of evidence II-III) < 7g/dL: Tx may be appropriate (recommendation grade 1C similar to level of evidence III-IV) Cardiovascular diseases/ ischemia Stable: can be managed with Hb 6-7g/dL Symptomatic: manage with Hb 9-10g/dL (recommendation grade 1B similar to level of evidence III–IV)
						1					1		1 (1.00)	
		I21.9 Coronary bypass N=115		74 (64.3)	31	43				8	57	9		
					69	99				18	124	26	168 (2.27)	
		Q23.1 Valve replacement N=14		14 (100)	6	8				6	7	1		
					21	27				15	27	6	48 (3.43)	

International Classification of Diseases code (ICD-10)	Diseases according to etiology or system	ICD-10 diagnosis and number of patients admitted	Total patients admitted	Number of transfusion recipients (percentage)	Number of transfusion recipients / Number of UPRBC used								Total UPRBC used (units/ patient)	Guidelines for appropriate use of transfusions
					Sex		Age group (years)							
					F	M	<1	1-4	5-14	15- 44	45-64	> 65		
		I71.1 Abdominal aortic aneurysm N=8		6 (75)	3	3				2	3	1		
					10	21				10	14	7	31 (5.17)	
		I71.8 Ruptured aneurysm N=4		4 (100)	1	3					3	1		
					11	33					31	13	44 (11.00)	
		I71.1 Thoracic aneurysm N=6		4 (66.7)	2	2					3	1		
					10	9					15	4	19 (4.75)	
		S26 Pericardial puncture N=2		1 (50)		1						1		
						2						2	2 (2.00)	

International Classification of Diseases code (ICD-10)	Diseases according to etiology or system	ICD-10 diagnosis and number of patients admitted	Total patients admitted	Number of transfusion recipients (percentage)	Number of transfusion recipients / Number of UPRBC used								Total UPRBC used (units/ patient)	Guidelines for appropriate use of transfusions
					Sex		Age group (years)							
					F	M	<1	1-4	5-14	15- 44	45-64	> 65		
J00-J99	Interventions in diseases of the respiratory system		388	3 (0.8)	1	2					3			
					1	2					3		3 (1.00)	
		J94.9 Pleural drainage N=150		0										
													0	
		J15 Intubation N=180		0										
													0	
		Z43.0 Tracheotomy N=46		0										
													0	
		A16.5 Pleurotomy and pleurodesis N=2		0										
													0	

International Classification of Diseases code (ICD-10)	Diseases according to etiology or system	ICD-10 diagnosis and number of patients admitted	Total patients admitted	Number of transfusion recipients (percentage)	Number of transfusion recipients / Number of UPRBC used								Total UPRBC used (units/ patient)	Guidelines for appropriate use of transfusions
					Sex		Age group (years)							
					F	M	<1	1-4	5-14	15- 44	45-64	> 65		
		J47 Cyst removal associated with bronchiectasis N=1		0										
													0	
		C34 Lobectomy N=5		1 (20)		1					1			
						1					1		1 (1.00)	
		C34 Pneumonec-tomy N=4		2 (50)	1	1					2			
					1	1					2		2 (1.00)	

International Classification of Diseases code (ICD-10)	Diseases according to etiology or system	ICD-10 diagnosis and number of patients admitted	Total patients admitted	Number of transfusion recipients (percentage)	Number of transfusion recipients / Number of UPRBC used								Total UPRBC used (units/ patient)	Guidelines for appropriate use of transfusions
					Sex		Age group (years)							
					F	M	<1	1-4	5-14	15- 44	45-64	> 65		
K00-K93 C22-C26 D12	Interventions in diseases of the gastroin-testinal system		125	28 (22.4)	14	14	1		2	8	13	4		
					38	30	1		2	20	35	10	68 (2.43)	
		K65 Acute peritonitis N=3		1 (33.3)		1			1					
						1			1				1 (1.00)	
		C22.7 Liver cancer resection N=6		5 (83.3)	2	3				2	3			
					8	14				8	14		22 (4.40)	
		K80.2 Laparoscopic vesicular resec-tion associated with lithiasis N=36		1 (2.8)	1					1				
					1					1			1 (1.00)	
		C25.4 Pancreatic cancer resection N=9		6 (66.7)	4	2				3	3			
					14	6				9	11		20 (3.33)	

International Classification of Diseases code (ICD-10)	Diseases according to etiology or system	ICD-10 diagnosis and number of patients admitted	Total patients admitted	Number of transfusion recipients (percentage)	Number of transfusion recipients / Number of UPRBC used								Total UPRBC used (units/ patient)	Guidelines for appropriate use of transfusions
					Sex		Age grou p(years)							
					F	M	<1	1-4	5-14	15- 44	45-64	> 65		
		K26 Duodenal ulcer N=8		2 (25)	2						1	1		
					8						3	5	8 (4.00)	
		K56.2 Ileum and colon volvuli N=7		4 (57.1)	1	3					2	2		
					2	4					2	4	6 (1.50)	
		K91.4, Z46.5 Colostomy associated with colon cancer N=10		1 (10)		1					1			
						1					1		1 (1.00)	
		D12.6 Removal of colon polyps N=7		1 (14.3)		1					1			
						1					1		1 (1.00)	

International Classification of Diseases code (ICD-10)	Diseases according to etiology or system	ICD-10 diagnosis and number of patients admitted	Total patients admitted	Number of transfusion recipients (percentage)	Number of transfusion recipients / Number of UPRBC used								Total UPRBC used (units/ patient)	Guidelines for appropriate use of transfusions
					Sex		Age group (years)							
					F	M	<1	1-4	5-14	15- 44	45-64	> 65		
		K55.8 Intestinal resection associated with angioma N=1		1 (100)	1						1			
					2						2		2 (2.00)	
		K50 Resection associated with ulcerative colitis N=5		1 (20)		1				1				
						1				1			1 (1.00)	
		K57.2 Resection of diverticula of the colon complicated with perfora-tion and abscesses N=3		1 (33.3)		1					1			
						1					1		1 (1.00)	
		K60, K62, C20 Rectal resection N=13		1 (7.7)	1							1		
					1							1	1 (1.00)	

International Classification of Diseases code (ICD-10)	Diseases according to etiology or system	ICD-10 diagnosis and number of patients admitted	Total patients admitted	Number of transfusion recipients (percentage)	Number of transfusion recipients / Number of UPRBC used								Total UPRBC used (units/ patient)	Guidelines for appropriate use of transfusions
					Sex		Age group (years)							
					F	M	<1	1-4	5-14	15- 44	45-64	> 65		
		K22.2 Esophageal dilatation associated with obstruction N=2		1 (50)	1					1				
					1					1			1 (1.00)	
		K66.0 Laparotomy (adherences, infection) N=12		1 (8.3)	1				1					
					1				1				1 (1.00)	
		K91.4 Colostomy closure N=3		1 (33.3)		1	1							
						1	1						1 (1.00)	

International Classification of Diseases code (ICD-10)	Diseases according to etiology or system	ICD-10 diagnosis and number of patients admitted	Total patients admitted	Number of transfusion recipients (percentage)	Number of transfusion recipients / Number of UPRBC used								Total UPRBC used (units/ patient)	Guidelines for appropriate use of transfusions
					Sex		Age group (years)							
					F	M	<1	1-4	5-14	15- 44	45-64	> 65		
R00-R99	Symptoms, signs, and abnormal laboratory findings		43	0										
													0	
Z00-Z99	Factors that influence health status and contact with the health services		93	0										
													0	

International Classification of Diseases code (ICD-10)	Diseases according to etiology or system	ICD-10 diagnosis and number of patients admitted	Total patients admitted	Number of transfusion recipients (percentage)	Number of transfusion recipients / Number of UPRBC used								Total UPRBC used (units/ patient)	Guidelines for appropriate use of transfusions
					Sex		Age group (years)							
					F	M	<1	1-4	5-14	15- 44	45-64	> 65		
J00-J99 A00-B99 E00-E90 L00-L99 G00-G99 F00-F99	Diseases of the respiratory system; parasitic, endocrine, skin, central nervous system, and psychiatric conditions		426	0										
													0	

International Classification of Diseases code (ICD-10)	Diseases according to etiology or system	ICD-10 diagnosis and number of patients admitted	Total patients admitted	Number of transfusion recipients (percentage)	Number of transfusion recipients / Number of UPRBC used								Total UPRBC used (units/ patient)	Guidelines for appropriate use of transfusions
					Sexo		Grupos de edad (años)							
					F	M	<1	1-4	5-14	15- 44	45-64	> 65		
S00-T98	Injury, poisoning, and other consequences of external causes		235	87 (37)	36	51		3	8	27	32	17		
					119	170		8	26	94	94	67	289 (3.32)	
		S42 Humeral fracture N=8 Femoral fracture N=23		27 (87.1)	8	19			1	1	16	9		Acute or massive hemorrhage Acute loss of >40% blood volume or loss of >30% blood volume if patient has tachypnea, tachycardia >130 bpm, no capillary filling, pallor with persistent hypotension, Hb < 7g/dL If patient has difficulty activating compensation mechanisms, administer 8-9g/dL Hb (recommendation grade 1B similar to level of evidence II-III)
					24	49			2	3	34	34	73 (2.70)	
		T02.0 Fractures of the head and neck N=4		2 (50)	1	1				1	1			
					3	5				3	5		8 (4.00)	
		S31, S40 Polytrauma N=17		5 (29.4)	2	3			1	2	1	1		
					14	16			4	7	12	7	30 (6.00)	

International Classification of Diseases code (ICD-10)	Diseases according to etiology or system	ICD-10 diagnosis and number of patients admitted	Total patients admitted	Number of transfusion recipients (percentage)	Number of transfusion recipients / Number of UPRBC used								Total UPRBC used (units/ patient)	Guidelines for appropriate use of transfusions
					Sex		Age group (years)							
					F	M	<1	1-4	5-14	15- 44	45-64	> 65		
		T08 Vertebral fractures N=4		3 (75)	3						1	2		
					8						3	5	8 (2.67)	
		S07.9 N= 1 **S06.3** N=8 **S06.2** N=6 Skull fractures N=15		8 (53.3)	3	5		1	2	3	1	1		
					9	14		3	5	10	2	3	23 (2.88)	
		S82.2 Fractures of the tibia and perone N=9		0										
													0	
		T31.3 Burns affecting over 30% of the body N=13		13 (100)	7	6		2	3	5	2	1		
					27	29		5	12	25	9	5	56 (4.31)	

International Classification of Diseases code (ICD-10)	Diseases according to etiology or system	ICD-10 diagnosis and number of patients admitted	Total patients admitted	Number of transfusion recipients (percentage)	Number of transfusion recipients / Number of UPRBC used								Total UPRBC used (units/ patient)	Guidelines for appropriate use of transfusions
					Sex		Age group (years)							
					F	M	<1	1-4	5-14	15- 44	45-64	> 65		
		W32 Gun injuries N=12		5 (41.7)	1	4				3	2			
					4	21				16	9		25 (5.00)	
		W26 Knife injuries N=20		9 (45)	2	7				5	3	1		
					3	15				9	6	3	18 (2.00)	
		S36.0 Ruptured spleen N=3		3 (100)	2	1			1	2				
					4	3			3	4			7 (2.33)	
		S36.7 Ruptured liver and intestinal perforation N=4		14 (100)	2	2				1	2	1		
					9	13				6	9	7	22 (5.50)	

International Classification of Diseases code (ICD-10)	Diseases according to etiology or system	ICD-10 diagnosis and number of patients admitted	Total patients admitted	Number of transfusion recipients (percentage)	Number of transfusion recipients / Number of UPRBC used								Total UPRBC used (units/ patient)	Guidelines for appropriate use of transfusions
					Sex		Age group (years)							
					F	M	<1	1-4	5-14	15- 44	45-64	> 65		
		S43.0 Shoulder dislocation N=55		0										
													0	
		S13.1 Cervical vertebra dislocation N=3		0										
													0	
		S10.9 Superficial neck injury N=24		0										
													0	
		S40, S70.1 Traumatic hematoma of the limbs N=45		8 (7.8)	5	3				4	3	1		
					14	5				11	5	3	19 (2.38)	

International Classification of Diseases code (ICD-10)	Diseases according to etiology or system	ICD-10 diagnosis and number of patients admitted	Total patients admitted	Number of transfusion recipients (percentage)	Number of transfusion recipients / Number of UPRBC used								Total UPRBC used (units/ patient)	Guidelines for appropriate use of transfusions
					Sex		Age group (years)							
					F	M	<1	1-4	5-14	15- 44	45-64	> 65		
M00-M99	Interventions in diseases of the musculoskeletal system and connective tissue (including orthopedic conditions)		269	108 (40.2)	59	49			19	36	25	28		
					121	108			41	102	39	47	229 (2.12)	
		M16 Hip replacement N=69		45 (65.2)	24	21					18	27		If Hb is: >10g/dL: Tx is not indicated (recommendation grade 1A similar to level of evidence I) >7 and <10g/dL: Tx can be indicated but there should be rationale (recommendation grade 1B similar to level of evidence II-III) < 7g/dL: very probable that Tx is appropriate (recommendation grade 1C similar to level of evidence III-IV) Cardiovascular disease/ ischemia Stable: can be managed with 6-7g/dL Hb Symptomatic: manage with 9-10g/dL Hb (recommendation grade 1B similar to level of evidence III-IV)
					34	32					21	45	66 (1.47)	
		M17 Knee replacement N=12		5 (41.7)	4	1					4	1		
					7	2					7	2	9 (1.80)	
		M23.2 Meniscus N=27		0										
													0	

International Classification of Diseases code (ICD-10)	Diseases according to etiology or system	ICD-10 diagnosis and number of patients admitted	Total patients admitted	Number of transfusion recipients (percentage)	Number of transfusion recipients / Number of UPRBC used								Total UPRBC used (units/ patient)	Guidelines for appropriate use of transfusions
					Sex		Age group (years)							
					F	M	<1	1-4	5-14	15- 44	45-64	> 65		
		M23 Cruciate ligaments N=23		15 (65.2)	7	8			6	7	2			
					9	11			7	8	5		20 (1.33)	
		M41 Scoliosis N=41		33 (80.5)	19	14			12	21				
					60	47			31	76			107 (3.24)	
		M51 Intervertebral disk hernias N=55		5 (9.1)	3	2				4	1			
					6	6				6	6		12 (2.40)	
		M35.3 Vascular malformations in the connective tissue (multifocal fibrosclerosis) N=2		0										
													0	

International Classification of Diseases code (ICD-10)	Diseases according to etiology or system	ICD-10 diagnosis and number of patients admitted	Total patients admitted	Number of transfusion recipients (percentage)	Number of transfusion recipients / Number of UPRBC used								Total UPRBC used (units/ patient)	Guidelines for appropriate use of transfusions
					Sex		Age group (years)							
					F	M	<1	1-4	5-14	15- 44	45-64	> 65		
		M18.0, M18.2, M18.3 Arthrosis of the hand N=12		0										
													0	
		M21.1, M21.2 Hallux valgus N=15		0										
													0	
		M22.0 Recurrent dislocation of the patella N=4		0										
													0	
		C40.2 Resection of femoral sarcoma N=4		2 (50)	1	1			1	1				
					2	3			3	2			5 (2.50)	

International Classification of Diseases code (ICD-10)	Diseases according to etiology or system	ICD-10 diagnosis and number of patients admitted	Total patients admitted	Number of transfusion recipients (percentage)	Number of transfusion recipients / Number of UPRBC used								Total UPRBC used (units/ patient)	Guidelines for appropriate use of transfusions
					Sex		Age group (years)							
					F	M	<1	1-4	5-14	15- 44	45-64	> 65		
		C41.4 Pelvic sarcoma resection N=2		2 (100)		2				2				
						7				7			7 (3.50)	
		C40.2 Amputation associated with cancer N=3		1 (33.3)	1					1				
					3					3			3 (3.00)	

International Classification of Diseases code (ICD-10)	Diseases according to etiology or system	ICD-10 diagnosis and number of patients admitted	Total patients admitted	Number of transfusion recipients (percentage)	Number of transfusion recipients / Number of UPRBC used								Total UPRBC used (units/ patient)	Guidelines for appropriate use of transfusions
					Sex		Age group (years)							
					F	M	<1	1-4	5-14	15- 44	45-64	> 65		
N00-N99	Interventions in diseases of the genitourinary system		389	98 (25.2)	19	79			1	7	48	42		
					54	186			4	15	133	88	240 (2.47)	
		N17, N18 Chronic and acute renal failure, dialysis N=28		7 (25)	4	3			1	2	2	2		
					11	9			4	3	6	7	20 (2.86)	
		N40, C61 Prostate adenoma resection N=121		69 (57)		69					31	38		
						146					77	69	146 (2.12)	

International Classification of Diseases code (ICD-10)	Diseases according to etiology or system	ICD-10 diagnosis and number of patients admitted	Total patients admitted	Number of transfusion recipients (percentage)	Number of transfusion recipients / Number of UPRBC used								Total UPRBC used (units/ patient)	Guidelines for appropriate use of transfusions
					Sex		Age group (years)							
					F	M	<1	1-4	5-14	15- 44	45-64	> 65		
		N43 Hydrocele N=5		0										
													0	
		Q62, Q62.5, Q62.6 Reimplanta-tion, resection, and recon-struction of ureter N= 4		2 (50)		2					2			
						2					2		2 (1.00)	
		C66 Malignant neoplasm of the ureter N=1		0										
													0	
		N28 , N26, Q61.3 Nephrectomy N=5		3 (60)	2	1				1	2			
					6	5				3	8		11 (3.67)	

International Classification of Diseases code (ICD-10)	Diseases according to etiology or system	ICD-10 diagnosis and number of patients admitted	Total patients admitted	Number of transfusion recipients (percentage)	Number of transfusion recipients / Number of UPRBC used								Total UPRBC used (units/ patient)	Guidelines for appropriate use of transfusions
					Sex		Age group (years)							
					F	M	<1	1-4	5-14	15- 44	45-64	> 65		
		N29 Nephrostomy N=3		0										
													0	
		N33 Bladder polyp N=4		2 (50)		2					2			
						9					9		9 (4.50)	
		C67 Bladder esection associated with bladder cancer N=3		3 (100)	1	2					2	1		
					8	15					13	10	23 (7.67)	
		C50 Breast lumpectomy N=18		0										
													0	

International Classification of Diseases code (ICD-10)	Diseases according to etiology or system	ICD-10 diagnosis and number of patients admitted	Total patients admitted	Number of transfusion recipients (percentage)	Number of transfusion recipients / Number of UPRBC used								Total UPRBC used (units/ patient)	Guidelines for appropriate use of transfusions
					Sex		Age group (years)							
					F	M	<1	1-4	5-14	15- 44	45-64	> 65		
		C55 Hysterectomy associated with cancer N=10		4 (40)	4					1	2	1		
					9					2	5	2	9 (2.25)	
		D25 Hysterectomy associated with myoma N=8		0										
													0	
		C56 Ovariectomy N=7		2 (28.6)	2					1	1			
					7					3	4		7 (3.50)	
		C55 Hysterosalp-ingectomy N=2		2 (100)	2					2				
					4					4			4 (2.00)	
		N30 Urethrocys-toscopy associ-ated with recurrent cystitis N=45		0										
													0	

International Classification of Diseases code (ICD-10)	Diseases according to etiology or system	ICD-10 diagnosis and number of patients admitted	Total patients admitted	Number of transfusion recipients (percentage)	Number of transfusion recipients / Number of UPRBC used								Total UPRBC used (units/ patient)	Guidelines for appropriate use of transfusions
					Sex		Age group (years)							
					F	M	<1	1-4	5-14	15- 44	45-64	> 65		
		N75 Drainage associated with- bartholinitis N=14		0										
													0	
		N70 Tubal resection associated with salpingitis N=49		4 (8.2)	4						4			
					9						9		9 (2.25)	
		N72 Biopsy associated with cervicitis N=62		0										
													0	

International Classification of Diseases code (ICD-10)	Diseases according to etiology or system	ICD-10 diagnosis and number of patients admitted	Total patients admitted	Number of transfusion recipients (percentage)	Number of transfusion recipients / Number of UPRBC used								Total UPRBC used (units/ patient)	Guidelines for appropriate use of transfusions
					Sex		Age group (years)							
					F	M	<1	1-4	5-14	15- 44	45-64	> 65		
G00-G99	Interventions by diseases of the central nervous system		136	30 (22.1)	13	17	1	2	6	14	5	2		
					29	64	1	5	23	49	12	3	93 (3.10)	
		I60.9 Subarachnoid aneurysm N=9		1 (11.1)		1				1				
						5				5			5 (5.00)	
		S09.9 Traumatic hematoma N=22		7 (31.8)	3	4			2	4		1		
					9	15			7	15		2	24 (3.43)	
		C71 Brain tumor N=33		2 (6.1)	1	1		1			1			
					3	3		3			3		6 (3.00)	

International Classification of Diseases code (ICD-10)	Diseases according to etiology or system	ICD-10 diagnosis and number of patients admitted	Total patients admitted	Number of transfusion recipients (percentage)	Number of transfusion recipients / Number of UPRBC used								Total UPRBC used (units/ patient)	Guidelines for appropriate use of transfusions
					Sex		Age group (years)							
					F	M	<1	1-4	5-14	15- 44	45-64	> 65		
		Q03.1 Fistula placement associated with hydrocephalus N=19		2 (10.5)	2		1		1					
					2		1		1				2 (1.00)	
		D44.4 Resection of craniopharyngioma N=7		5 (71.4)	1	4			3	2				
					5	28			15	18			33 (6.60)	
		C31.1 Infected ethmoidal tumor N=1		1 (1)		1				1				
						1				1			1 (1.00)	
		Q75.0 Craniostenosis N=7		1 (14.3)	1			1						
					2			2					2 (2.00)	

International Classification of Diseases code (ICD-10)	Diseases according to etiology or system	ICD-10 diagnosis and number of patients admitted	Total patients admitted	Number of transfusion recipients (percentage)	Number of transfusion recipients / Number of UPRBC used								Total UPRBC used (units/ patient)	Guidelines for appropriate use of transfusions
					Sex		Age group (years)							
					F	M	<1	1-4	5-14	15- 44	45-64	> 65		
		H92.2 Examination of otorrhagia N=6		0										
													0	
		C75.1 Hypophysis tumors N=8		0										
													0	
		C3.1 Malignant tumor of the middle ear N=2		1 (50)		1					1			
						1					1		1 (1.00)	
		C31 Malignant tumor of paranasal sinuses N=1		0										
													0	

International Classification of Diseases code (ICD-10)	Diseases according to etiology or system	ICD-10 diagnosis and number of patients admitted	Total patients admitted	Number of transfusion recipients (percentage)	Number of transfusion recipients / Number of UPRBC used								Total UPRBC used (units/ patient)	Guidelines for appropriate use of transfusions
					Sex		Age group (years)							
					F	M	<1	1-4	5-14	15- 44	45-64	> 65		
		S34.5, S54.0, S54.7, S64.2 Repair of cutaneous nerves N=18		5 (27.8)	2	3				3	1	1		
					2	4				4	1	1	6 (1.20)	
		C70.1, C72.0 Extra-medullary laminectomy associated with tumors and/or abscesses N=8		5 (62.5)	3	2				3	2			
					6	7				6	7		13 (2.60)	

III. Obstetric-gynecological conditions

International Classification of Diseases code (ICD-10)	Diseases according to etiology or system	ICD-10 diagnosis and number of patients admitted	Total patients admitted	Number of transfusion recipients (percentage)	Number of transfusion recipients / Number of UPRBC used								Total UPRBC used (units/ patient)	Guidelines for appropriate use of transfusions
					Sex		Age group (years)							
					F	M	<1	1-4	5-14	15- 44	45-64	> 65		
O00-O99	Pregnancy, childbirth, and the puerperium	Deliveries N=4085 Other N = 633	4718	321 (6.8)	321				46	229	46			Anemia Pregnant patient with symptoms of anemia and Hb < 7g/dL: Tx is indicated (recommendation grade 1C similar to level of evidence IV) Peripartum hemorrhage is treated as any acute and/or massive hemorrhage
					712				95	524	93		712 (2.22)	
		O80.0 Spontaneous delivery N=2995		150 (5)	150				17	106	27			
					165				19	113	33		165 (1.10)	
		O71, O72 Peripartum hemorrhage N=78		71 (91)	71				8	54	9			
					314				19	262	33		314 (4.42)	
		O82 Caesarean section N=1005		3 (0.3)	3					2	1			
					4					2	2		4 (1.33)	

International Classification of Diseases code (ICD-10)	Diseases according to etiology or system	ICD-10 diagnosis and number of patients admitted	Total patients admitted	Number of transfusion recipients (percentage)	Number of transfusion recipients / Number of UPRBC used								Total UPRBC used (units/ patient)	Guidelines for appropriate use of transfusions
					Sex		Age group (years)							
					F	M	<1	1-4	5-14	15- 44	45-64	> 65		
		O80.1 Delivery with forceps or cup N=85		1 (1.2)	1					1				
					1					1			1 (1.00)	
		O14.1 HELLP syndrome N=13		13 (100)	13				2	10	1			
					43				8	35			43 (3.31)	
		O07.9 Inevitable abortion N=387		12 (3.1)	12				2	9	1			
					13				2	10	1		13 (1.08)	
		O07.5 Abortions complicated by infection N=55		12 (21.8)	12				4	6	2			
					27				12	8	7		27 (2.2)	

International Classification of Diseases code (ICD-10)	Diseases according to etiology or system	ICD-10 diagnosis and number of patients admitted	Total patients admitted	Number of transfusion recipients (percentage)	Number of transfusion recipients / Number of UPRBC used								Total UPRBC used (units/ patient)	Guidelines for appropriate use of transfusions
					Sex		Age group (years)							
					F	M	<1	1-4	5-14	15- 44	45-64	> 65		
		O07.6 Abortions complicated by excessive or late bleeding N=34		33 (97.1)	33				9	20	4			
					82				26	41	15		82 (2.48)	
		O00 Ectopic pregnancy N=38		2 (5.3)	2					2				
					3					3			3 (1.50)	
		O88.2 Puerperal pulmonary embolism N=1		1 (100)	1					1				
					1					1			1 (1.00)	
		O85 Puerperal sepsis N=13		12 (92.3)	12				3	9				
					24				6	18			24 (2.00)	

International Classification of Diseases code (ICD-10)	Diseases according to etiology or system	ICD-10 diagnosis and number of patients admitted	Total patients admitted	Number of transfusion recipients (percentage)	Number of transfusion recipients / Number of UPRBC used								Total UPRBC used (units/ patient)	Guidelines for appropriate use of transfusions
					Sex		Agre group (years)							
					F	M	<1	1-4	5-14	15- 44	45-64	> 65		
		O45 Premature detachment of the placenta N=14		11 (78.6)	11				1	9	1			
					35				3	30	2		35 (3.18)	

IV. Conditions of the neonatal period

International Classification of Diseases code (ICD-10)	Diseases according to etiology or system	ICD-10 diagnosis and number of patients admitted	Total patients admitted	Number of transfusion recipients (percentage)	Number of transfusion recipients / Number of UPRBC used								Total UPRBC used (units/ patient)	Guidelines for appropriate use of transfusions
					Sex		Afe group (years)							
					F	M	<1	1-4	5-14	15- 44	45-64	> 65		
P00-P96 Q00-Q99	Certain disorders of the perinatal period and congenital malforma-tions		4.112 Live births	165 (4)	76	89	165							Transfusion of PRBC can be considered when: ≤ 35-40% Hct in patients with mechanical ventilation, 35-40% inspired oxygen fraction requirement ≤ 28-30% Hct in patients with mechanical ventilation, < 35-40% inspired oxygen fraction requirement < 20% Hct in symptomatic or asymptomatic patients, < 100,000 reticulocytes per µL Chronic or acute critical patients (cancer, respiratory disease, cerebrovascular disease) If Hb is: >10g/dL: Tx is not indicated (level of evidence I)
					168	198	366						366 (2.22)	
		P07.1 N=267 < 2,200 g		73 (27.3)	34	39	73							
					63	76	139						139 (1.90)	
		P07.1 N=24 < 1200 g		21 (87.5)	10	11	21							
					31	38	69						69 (3.29)	

International Classification of Diseases code (ICD-10)	Diseases according to etiology or system	ICD-10 diagnosis and number of patients admitted	Total patients admitted	Number of transfusion recipients (percentage)	Number of transfusion recipients / Number of UPRBC used								Total UPRBC used (units/ patient)	Guidelines for appropriate use of transfusions
					Sexo		Grupos de edad (años)							
					F	M	<1	1-4	5-14	15- 44	45-64	> 65		
		P77 Necrotizing enteritis N=24		24 (100)	11	13	24							7-10g/dL: Tx can be indicated but there should be rationale (level of evidence IV) < 7g/dL: Tx may be indicated (level of evidence IV) In stable patients or when blood is not available substitute treatments can be adm inistered (e.g., iron, folates)
					27	28	55						55 (2.29)	
		P36 Neonatal sepsis N=15		3 (20)		3	3							
						4	4						4 (1.33)	
		P53 Hemorrhagic disease N=15		13 (86.7)	8	5	13							
					21	13	34						34 (2.62)	
		P55 Hemolytic disease associated with blood incompatibility N=9		9 (100)	4	5	9							
					9	12	21						21 (2.33)	

International Classification of Diseases code (ICD-10)	Diseases according to etiology or system	ICD-10 diagnosis and number of patients admitted	Total patients admitted	Number of transfusion recipients (percentage)	Number of transfusion recipients / Number of UPRBC used								Total UPRBC used (units/ patient)	Guidelines for appropriate use of transfusions
					Sex		Age group (years)							
					F	M	<1	1-4	5-14	15- 44	45-64	> 65		
		P10 Subdural hemorrhage associated with injury N=12		11 (91.7)	5	6	11							
					8	11	19						19 (1.73)	
		Q36 Harelip without cleft palate N=3		0										
													0	
		Q37 Harelip with cleft palate N=3		0										
													0	
		Q21.3 Tetralogy of Fallot N=3		3 (100)	1	2	3							
					2	5	7						7 (2.33)	

International Classification of Diseases code (ICD-10)	Diseases according to etiology or system	ICD-10 diagnosis and number of patients admitted	Total patients admitted	Number of transfusion recipients (percent-age)	Number of transfusion recipients / Number of UPRBC used								Total UPRBC used (units/ patient)	Guidelines for appropriate use of transfusions
					Sex		Age group (years)							
					F	M	<1	1-4	5-14	15- 44	45-64	> 65		
		Q21 Interventricular communication N=3		1 (33.3)		1								
						2							2 (2.00)	
		Q05 Spina bifida N=4		4 (100)	2	2	4							
					6	7	13						13 (3.25)	
		Q62.1 Ureter atresia N=3		0										
													0	
		Q03 Congenital hydrocephalus N=3		1 (33.3)		1	1							
						1	1						1 (1.00)	

International Classification of Diseases code (ICD-10)	Diseases according to etiology or system	ICD-10 diagnosis and number of patients admitted	Total patients admitted	Number of transfusion recipients (percentage)	Number of transfusion recipients / Number of UPRBC used								Total UPRBC used (units/ patient)	Guidelines for appropriate use of transfusions
					Sex		Age group (years)							
					F	M	<1	1-4	5-14	15- 44	45-64	> 65		
	Q44.2 Bile duct atresia N=3			2 (66.7)	1	1	2							
					1	1	2						2 (1.00)	

SUMMARY

Diseases according to etiology or system	Total patients admitted	Number of transfusion recipients (percentage)								Total (percentage)
		Sex		Age groups (years)						
		F	M	<1	1-4	5-14	15- 44	45-64	> 65	
I. Clinical conditions	1,087	261 (60.7)	169 (39.3)	11 (2.6)	39 (9.1)	74 (17.2)	108 (25.1)	111 (25.8)	87 (20.2)	430 (39.6)
II. Surgical interventions	2,277	185 (40.4)	273 (59.6)	2 (0.4)	5 (1.1)	36 (7.9)	108 (23.6)	200 (43.7)	107 (23.4)	458 (20.1)
III. Obstetric-gynecological conditions	4,718	321 (100)	0	0	0	46 (14.3)	229 (71.3)	46 (14.3)	0	321 (6.8)
IV. Conditions of the neonatal period	4,112	76 (46.1)	89 (53.9)	165 (100)	0	0	0	0	0	165 (4)
Total	12,194	843 (61.4)	531 (38.6)	178 (13)	44 (3.2)	156 (11.4)	445 (32.4)	357 (26.0)	194 (14.1)	1,374 (11.3)

Diseases according to etiology or system	Total transfusion recipients	Number of UPRBC used (percentage)								Total (percentage)
		Sex		Age group (years)						
		F	M	<1	1-4	5-14	15- 44	45-64	> 65	
I. Clinical conditions	430	1,409 (58)	1,021 (42)	31 (1.3)	139 (5.7)	415 (17.1)	825 (34.05)	623 (25.6)	397 (16.3)	2,430 (51.2)
II. Surgical interventions	458	483 (39.1)	752 (60.9)	2 (0.2)	13 (1.1)	96 (7.8)	323 (26.2)	527 (42.7)	273 (22.1)	1,234 (26.0)
III. Obstetric-gynecological conditions	321	712 (100)	0	0	0	95 (13.3)	524 (73.6)	93 (13.1)	0	712 (15.0)
IV. Conditions of the neonatal period	165	168 (45.9)	198 (54.1)	366 (100)	0	0	0	0	0	366 (7.7)
Total	1,374	2,772 (58.5)	1,971 (41.6)	399 (8.4)	152 (3.2)	606 (12.8)	1,672 (35.3)	1,243 (26.2)	670 (14.1)	4,742

Diseases according to etiology or system	Total transfusion recipients	Average UPRBC used by patient								Average
		Sex		Age group (years)						
		F	M	<1	1-4	5-14	15- 44	45-64	> 65	
I. Clinical conditions	430	5.39	6.04	2.82	3.56	5.61	7.64	5.61	4.56	5.65
II. Surgical interventions	458	2.61	2.75	1.00	2.60	2.67	2.99	2.64	2.55	2.69
III. Obstetric-gynecological conditions	321	2.22	0	0	0	2.07	2.29	2.02	0	2.22
IV. Conditions of the neonatal period	165	2.21	2.22	2.22	0	0	0	0	0	2.22
Total	1,374	3.29	3.71	2.24	3.45	3.88	3.76	3.48	3.45	3.45

Since this hospital offers specialized gynecology/obstetrics and neonatology services, the data does not necessarily represent the percentage of consumption of PRBC in the Autonomous City of Buenos Aires as care was probably provided for a higher number of pregnant women at risk that required more transfusions. Furthermore, in this example clinical care is more common than surgical care, which leads to a low percentage of blood consumption in the surgical specialties.

Estimated Need for Blood		
Past real need in the hospital (NH_n)	=	Hospital use + procedures not performed
Estimated future need (EFN)	=	(NH_1 + NH_2 + … NH_n) x change in age groups
Planned future need (PFN)	=	EFN + increased service coverage
Annual national need for blood (ANN)	=	PFN + 4%

ANNEX D

Validation of the Methodology and Instrument Proposed by PAHO

Validation of the methodology and instrument proposed by PAHO

The methodology and instrument proposed by PAHO were validated in Nicaragua by 20 professionals from nine hospitals with the support of five staff members from the Department of Education and Research of the Ministry of Health and the Technical Coordinator from Luxembourg Cooperation. The evaluators described the document as "excellent." However, they identified weaknesses in the description of the background since it did not include data on Latin America and in the quality of the tables since the three age groups proposed originally (0-14 years, 15-65 years, and over 65 years) were considered to be too broad. All of the other parameters included in the validation had average scores of greater than 93% (Table A1). The results of the field work were presented at a workshop held in Managua, Nicaragua on 17-18 December 2009. Valuable lessons have been learned from validation and subsequent discussion of the document, some of the most noteworthy of which are as follows:

- The number of transfusion recipients during the year varies from month to month and does not follow the same pattern as the fluctuation in the number of patients admitted to the hospital (Table A2) (Quintana R, Aguirre H, Somarriba R).
- In the general hospitals included in the validation exercise, women received a higher percentage of blood transfusions than men. The male/female ratio of transfusions varies from hospital to hospital (Table A3).
- Patients aged 15 to 64 received the highest percentage of transfusions, with variations from hospital to hospital (Table A4).
- Better results are obtained when calculating the demand for transfusions by patient age if there are small intervals between age groups (Table A5).
- The percentage of transfusion recipients and number of units used depend on the clinical condition (Table A6) (Centeno Mena RA, Sánchez López ML).
- The need for red blood cells is related to the prevalent conditions in the community, age structure of the population, and patterns of blood use. Therefore, in the department of Estelí it was estimated that with annual population growth of 1.9%, the red blood cell requirements will increase by 11% in 2010 (Alfaro Lanuza C, López Urbina BR). The number of units of red blood cells used per hospital bed varies from hospital to hospital (Table A7).

TABLE A1. Validation of the instrument proposed by PAHO, Nicaragua, 2009

	A	B	C	D	E	F	G	Total	Average
Rationale									
Clarity	5	10	10	10	10		10	55	9.17
Sufficiency	5	10	10	10	10		10	55	9.17
Usefulness	8	10	10	10	10	10	10	68	9.71
Organization of information									
Clarity	8	10	10	10	10		8	56	9.33
Sufficiency	9	10	10	10	10		10	59	9.83
Usefulness	9	10	10	10	10	10	10	69	9.86
Definition of concepts									
Clarity	6	10	10	10	10		10	56	9.33
Sufficiency	6	10	10	10	10		10	56	9.33
Usefulness	7	10	10	10	10	10	10	67	9.57
Description of problem									
Clarity	8	10	10	10	10		10	58	9.67
Sufficiency	7	10	10	10	10		10	57	9.50
Usefulness	8	10	10	10	10	10	10	68	9.71
Description of background									
Clarity	5	10	10	10	10		8	53	8.83
Sufficiency	5	8	10	10	10		8	51	8.50
Usefulness	6	8	10	10	10	10	10	64	9.14
Relationship between background and proposal									
Clarity	8	7	10	10	10		10	55	9.17
Sufficiency	8	7	10	10	10		10	55	9.17
Usefulness	8	9	10	10	10	10	10	67	9.57
Figures									
Clarity	6	5	10	10	10		10	51	8.50
Sufficiency	6	5	10	10	10		10	51	8.50
Usefulness	8	5	10	10	10	9	10	62	8.86
Matrix									
Clarity	9	10	10	10	10		10	59	9.83
Sufficiency	9	10	10	10	10		10	59	9.83
Usefulness	9	10	10	10	10	9	10	68	9.71
References									
Clarity	10	10	10	10	10		10	60	10.00
Sufficiency	10	10	10	10	10		8	58	9.67
Usefulness	10	10	10	10	10	10	10	70	10.00

TABLE A2. Number and percentage of transfusion recipients per month, first semester of 2009, Hospital Materno Infantil, Chinandega, Nicaragua

Month	Total patients admitted	Number of PRBC transfusion recipients	Percentage of PRBC transfusion recipients
January	1,384	18	1.30
February	1,515	36	2.37
March	1,536	38	2.47
April	1,470	43	2.92
May	1,547	48	3.10
June	1,398	15	1.07
Total	**8,850**	**198**	**2.23**

TABLE A3. Percentage of transfusions by sex and location, Nicaragua, 2009

Sex	San Juan	Matagalpa	Estelí	Juigalpa
Female	50 (76)	725 (66)	242 (57)	26 (54)
Male	16 (24)	374 (34)	181 (43)	22 (46)
Male/female ratio	**3.21**	**1.93**	**1.34**	**1.18**

TABLE A4. Percentage of transfusions by three age groups, Nicaragua, 2009

Age (years)	San Juan	Matagalpa	Estelí
0-14	8	27	8
15-64	74	67	59
>65	18	6	33

TABLE A5. Percentage of transfusions by eight age groups, Nicaragua, 2009

Age (years)	Somoto	Estelí
0-10	1.6	7.4
11-20	12.7	5.9
21-30	20.6	17.0
31-40	15.0	8.3
41-50	8.2	10.2
51-60	15.7	9.9
61-70	8.5	17.3
> 71	17.7	24.1

TABLE A6. Percentage of transfusion recipients by clinical condition, Nicaragua, 2009

Clinical condition	Patients admitted	Number (and percentage) of transfusion recipients	Units/ patient
Neoplasms	83	23 (28)	2.39
Hemorrhages of the digestive system	256	42 (16)	1.38
Diseases of the blood	236	91 (38)	1.39
Interventions in the gastrointestinal system	40	13 (33)	1.07
Injury and other consequences of external causes	317	19 (6)	1.84
Interventions in the musculoskeletal system	87	8 (9)	1.37
Interventions in the genitourinary system	155	18 (12)	1.11
Pregnancy, childbirth, and the puerperium	2.094	147 (7)	1.25
Perinatal period and congenital malformations	381	8 (2)	1.00

TABLE A7. Number of UPRBC used in 12 months per hospital bed, Nicaragua, 2009

Location	UPRBC used in 12 months	Beds	Units/Bed/Year
Río San Juan	304	68	4.47
Jinotega	1,024	206	4.97
Matagalpa	1,884	323	5.83

WORKSHOP ON VALIDATION OF THE METHODOLOGY

Managua, Nicaragua
December 2009

PRESENTATIONS

Analysis of Situation of PRBC Transfusions in Hospital Materno Infantil Mauricio Abdalah Chinandega

First Semester 2009

R. Quintana, H. Aguirre, R. Somarriba

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Introduction

Transfusion is an essential aspect of modern health services. When used correctly, it can save lives and improve health. However, transmission of infectious agents by blood and blood components has focused particular attention on the potential risks of transfusion.

The World Health Organization (WHO) has developed the following integrated strategies in order to promote worldwide blood safety and minimize the risks associated with transfusion:

1. Establishment of a nationally coordinated transfusion service with quality systems in all areas.
2. Collection of blood only from unpaid voluntary donors from low-risk populations.
3. Screening of all blood donated for transfusion-transmissible infections including human immunodeficiency virus (HIV), hepatitis virus, syphilis, and other infectious agents, and good laboratory practices in all aspects of blood classification, compatibility tests, preparation of blood components, and storage and transport of blood and blood components.
4. Reduction of unnecessary transfusions through appropriate clinical use of blood and blood components, and use of simple alternatives to transfusion whenever possible. As support for these strategies, WHO has produced a series of recommendations, guidelines, and educational materials, including the Recommendations on Developing a National Policy and Guidelines on the Clinical Use of Blood.

The recommendations emphasize the importance of education and training on the clinical use of blood for all clinical personnel and the blood bank involved in the transfusion process.

Objectives

General Objective: Describe the patterns of transfusion therapy with packed red blood cells in Hospital Materno Infantil of Chinandega from January to June 2009.

Specific Objectives:

- Describe the patterns of transfusion of packed red blood cells administered in the first six months of 2009 with regard to number of transfusions, reasons for transfusion, and clinical and surgical departments.
- Validate the PAHO data collection instrument on use of red blood cell transfusions in our hospital unit.

Methodological Design

Type of Study: A descriptive, observational, cross-sectional study was conducted in the transfusion service and the pediatrics, gynecology and obstetrics departments of Hospital Materno Infantil Mauricio Abdalah of Chinandega from January to June 2009.

Universe and Sample: The universe was made up of all patients admitted to the pediatrics and gynecology/obstetrics departments. The sample represents the cases of patients that required transfusion of packed red blood cells during the months of the study.

Data Collection Instruments: For performance of the study, information was obtained from the transfusion request, recording and monitoring form provided by the transfusion service at Hospital Materno Infantil of Chinandega. The patients' medical records were also reviewed.

Processing and Analysis: The data acquired was transferred to previously prepared input tables, which facilitated creation of databases. These were used for subsequent statistical analysis with the SPSS Version 17 statistical data processing software for Windows (in Spanish).

Donor Population by Geographical Area

- The population of the department of Chinandega is 500,000 inhabitants.
- If a rate of 100 donors for every 10,000 inhabitants is calculated, the donor population is 5,000 donors per year.
- With addition of a 4% reserve, it is equivalent to 200 more donors at the departmental level.
- The total donor population at the departmental level is 5,200 voluntary donors per year.

Analysis of the Blood Transfusion Situation at Hospital Materno Infantil of Chinandega

Description of the Departments

DEPARTMENT	NUMBER OF BEDS	%
GYNECOLOGY/OBSTETRICS		
PHYSIOLOGICAL PUERPERIUM	14	20.89
SURGICAL PUERPERIUM	14	20.89
PATHOLOGICAL PUERPERIUM	8	11.95
HIGH OBSTETRIC RISK	14	20.89
GYNECOLOGY	14	20.89
ISOLATION	3	4.49
SUB TOTAL	67	100

DEPARTMENT	NUMBER OF BEDS	%
PEDIATRICS		
PEDIATRIC MEDICINE	12	15.58
RESPIRATORY	15	19.48
CRITICAL CARE	7	9.09
GASTROENTEROLOGY	10	12.98
PEDIATRIC NEONATAL CARE	13	16.88
INTERM. NEONATAL CARE	20	25.97
SUB TOTAL	**77**	**53.47**
TOTAL REGISTERED BEDS	**144**	**100**

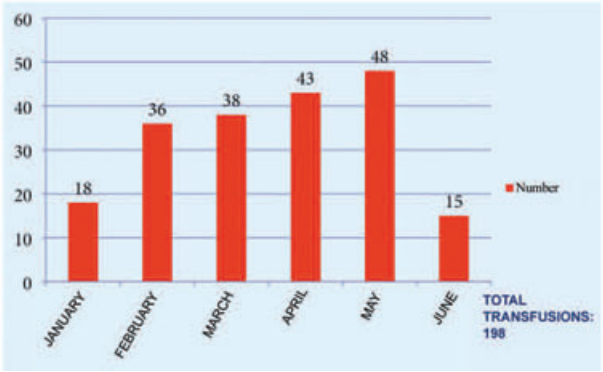
DEPARTMENT	NUMBER OF BEDS	%
UNREGISTERED BEDS		
LABOR AND DELIVERY	7	11.29
JOINT LODGING	28	45.16
ORAL REHYDRATION UNIT	3	4.84
TRAUMA UNIT	4	6.45
ADULT EMERGENCY	6	9.68
PEDIATRIC EMERGENCY	4	6.45
INTENSIVE NEONATAL	10	16.13
SUB TOTAL	62	100
GRAN TOTAL	206	100

Hospital Admissions – First Semester 2009

	2009
JANUARY	1,384
FEBRUARY	1,515
MARCH	1,536
APRIL	1,470
MAY	1,547
JUNE	1,398
TOTAL	8,850

Results

Transfusions Administered – First Semester 2009



Transfusions Administered By Specialty – First Semester 2009

MONTH	PEDIATRIC	GYN/OBS	2009
JANUARY	8	10	18
FEBRUARY	11	25	36
MARCH	12	26	38
APRIL	18	25	43
MAY	9	39	48
JUNE	5	10	15
TOTAL	63	135	198

Number and Percentage of Transfusion Recipients per Month – First Semester 2009

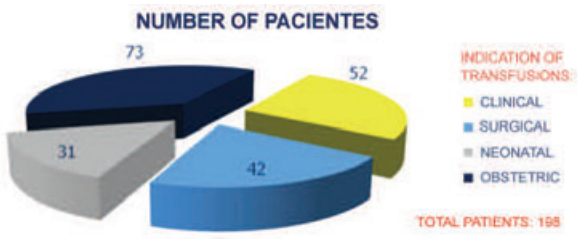
MONTH	TOTAL PATIENTS	PRBC TRANSFUSIONS	% TRANSFUSIONS 2009
JANUARY	1,384	18	1.30
FEBRUARY	1,515	36	2.38
MARCH	1,536	38	2.47
APRIL	1,470	43	2.93
MAY	1,547	48	3.10
JUNE	1.398	15	1.07
TOTAL	8,850	198	2.24

Number of PRBC Transfusion Recipients by Ward – First Semester 2009

WARD	NUMBER	%
MATERNITY	50	25.2
GENECOLOGRY	46	23.2
NEONATAL	31	16
HIGH OBSTETRICK RISK	26	13.1
PEDIATRIC MEDICINE	18	9
CRITICAL	14	7
ISOLATION	10	5
LABOR AND DELIVERY	3	1.5
TOTAL	198	100

ARO: Alto Riesgo Obstétrico

Transfusions Administered by Indication – First Semester 2009



Conclusions

- The total number of recipients of transfusions with packed red blood cells in the 6 month period was 198 patients. A total of 2.3% of the patients received transfusions.
- The month with the most transfusions was May with 48 (3.10%) patients.
- The area that administered the most PRBC was the gynecology/obstetrics department, particularly the maternity unit in this department.
- The primary indication for transfusion of PRBC was for obstetric reasons.

Observations for Completion of the Data Collection Form

1. There is limited data collection in the blood banks in our units since an adequate record of the age and sex of the patients is not kept. In the neonatology department, the name of the mother is specified on the cards.
2. There are difficulties in completion of the form since it includes a detailed account of a large number of conditions. Our hospital does not yet have these areas or specialties since its profile is merely maternal and child.
3. This study was performed partially based on the PAHO validation instrument and the guidelines and recommendations made by the tutors of the Diploma in Transfusion Medicine and Cooperation Luxembourg.

Recommendations

- Use a data collection format that considers the indications for transfusion, ward, condition, and the units administered at the national level.
- Implement the PAHO validation instrument for future collection of the data mentioned.

Evaluation of Transfusion Practices at Hospital Regional Asunción de Juigalpa from 1 May to 30 September 2009

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Objectives

General Objective: Evaluate the transfusion practices at Hospital Regional Asunción de Juigalpa from 1 May to 30 September 2009.

Specific Objectives:

1. Describe the general characteristics of the patients.
2. Evaluate the use of blood components and the criteria established by medical personnel to decide on blood transfusions.

Methodological Design

Type of Study: Descriptive, cross-sectional study performed at Hospital Regional Asunción de Juigalpa for a five-month period from May to September 2009.

Universe: Formed by 810 patients that received transfusions at Hospital Regional Asunción de Juigalpa from May to September 2009.

Sample: Forty-eight patients that fulfilled the inclusion criteria and received transfusions.

Inclusion Criteria

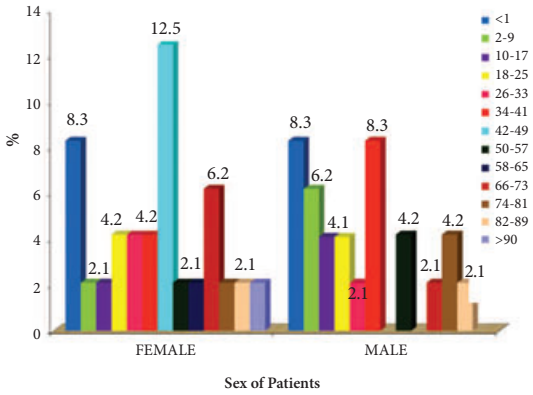
For Indication of Transfusion: Patient recipient of one of the following blood components: packed red blood cells, fresh frozen plasma, ordinary/simple plasma, platelets.

Exclusion Criteria

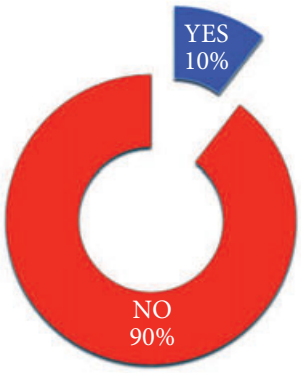
- Records not completed properly, without search guide (patient names do not agree with record).
- Patients without record number in the transfusion center log.
- Patients that did not receive transfusions.

Results

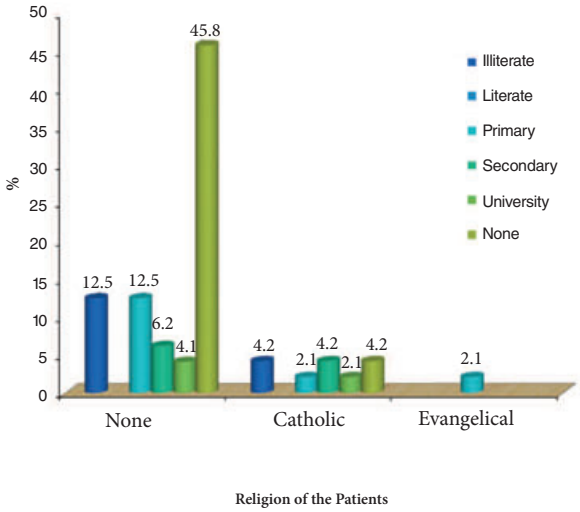
Graphic No. 1
Patient Age and Sex



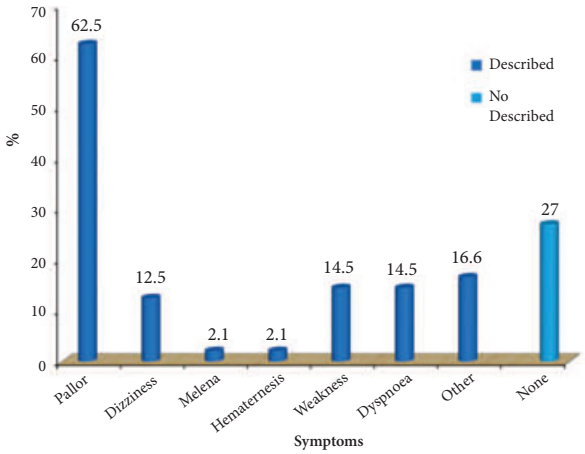
Graphic No. 2
History of Patient Transfusions



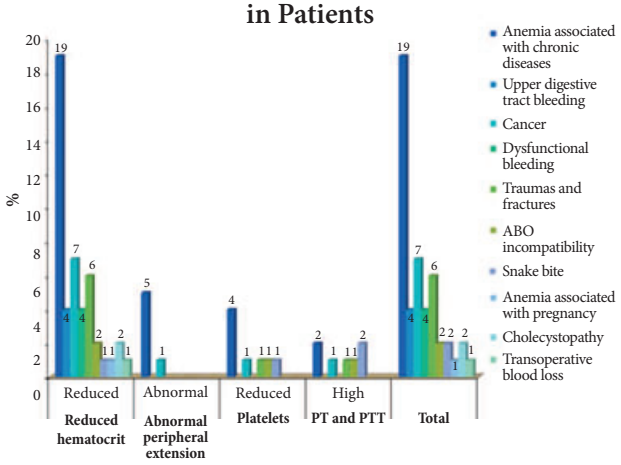
Graphic No. 3
Patient Education and Religion



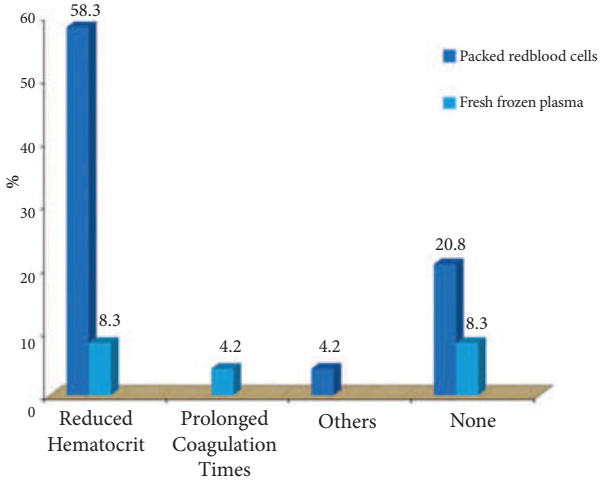
Graphic No. 4
Clinical Criteria - Patient Symptoms



Graphic No. 5
Pretransfusion Diagnosis - Laboratory Criteria in Patients

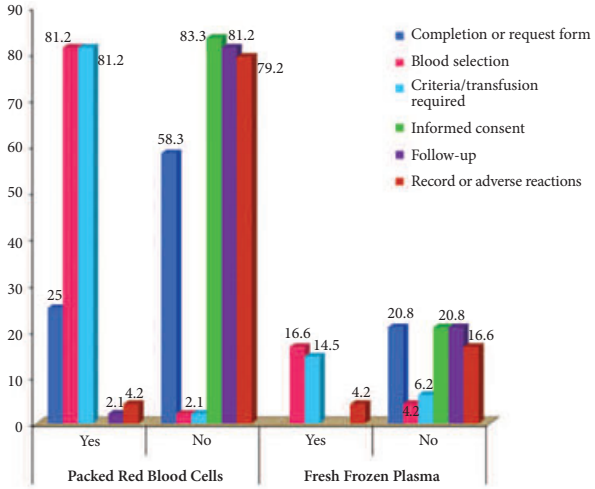


Graphic No. 6
Indication Recorded in Laboratory Test - Type of Blood Product Administered



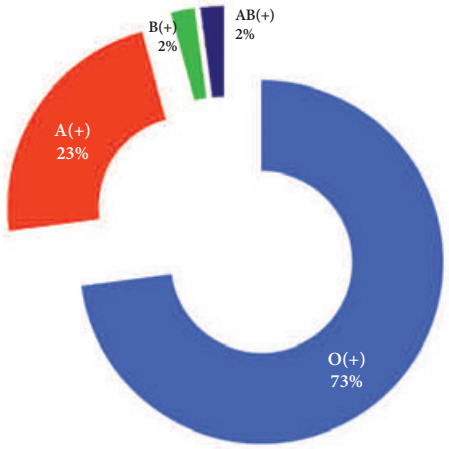
Graphic No. 7

Compliance with Standards - Type of Blood Product Administered



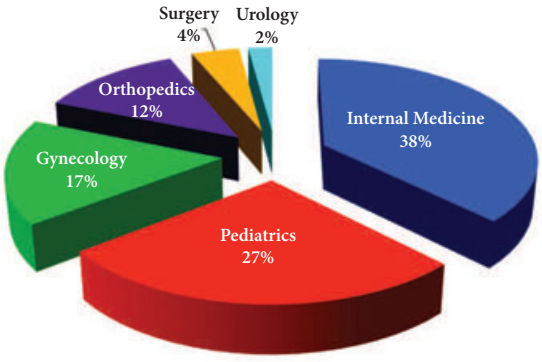
Graphic No. 8

Patient Blood Groups



Graphic No. 9

Department that Provided Care for Patients



Conclusions

1. The most frequent patient ages were children under 1 year and 34-49 years. The female sex predominated.
2. The most common academic levels in the patients were illiteracy and primary education. The religion was not indicated in most of the medical records.
3. Packed red blood cells and fresh frozen plasma were the blood components administered most to the patients. In the majority of the cases, the transfusion was evaluated as acceptable. However, in almost all cases the request form and informed consent form were not completed, and there was no follow-up.
4. The frequent pretransfusion diagnoses that led to transfusion of the patients were anemia associated with chronic disease, cancer, upper digestive tract bleeding, and trauma. The most frequent blood types were O(+) and A(+).
5. The departments that performed the most transfusions were: internal medicine, pediatrics, and gynecology.

Recommendations

1. Train the medical and paramedical personnel in transfusion medicine.
2. Adequate completion of the medical record, transfusion request form, and logs.
3. Record the indication for transfusion, beginning and end of transfusion, adverse reactions, and follow-up in the medical record.
4. Make rational use of the blood components.
5. Prepare guidelines for blood transfusion in the different departments.
6. Implement the PRBC needs estimate document proposed by PAHO according to the profile or category of each hospital, taking into account the sociodemographic characteristics of the population as well as the disease coding in our country.

Evaluation and Validation of the PAHO Document for Estimating the Need for Packed Red Blood Cells in the Transfusion Services of Hospital San Juan de Dios and Hospital La Trinidad of the Municipality of Estelí in 2010

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Introduction

Blood transfusion is a therapeutic measure.

It should not be used indiscriminately as there may be acute or late complications, or risk of transmission of infectious agents.

Application of standards is important in regulating the use of blood.

Access to blood and blood components is a matter of equity, justice, social responsibility, and humanism.

Validate (From lat. *validāre*). To give strength or firmness to something, make it valid.

The success of validation depends on the following factors:

- **Where the documents originate:** whether or not the sources are reliable.
- **Who creates them:** if they are created by an application automatically or by a user manually.
- **Who processes them:** errors can also be entered involuntarily when processing the data and documents.
- **Data quality:** if the documents are generated directly from a legacy database, they may not be entirely accurate or complete. en su totalidad.
- **Performance:** of the processor or apparatus that conducts validation.

Objectives

General Objective: Evaluate and validate the PAHO document for estimating the need for packed red blood cells (PRBC) in the transfusion services of Hospital San Juan de Dios and Hospital La Trinidad of the municipality of Estelí in 2010.

Specific Objectives:

- Describe the general characteristics of the recipients of PRBC transfusions in the transfusion services of Hospital San Juan de Dios and Hospital La Trinidad of the municipality of Estelí in June, July, and August 2009.
- Determine the clinical indications for transfusion of PRBC, the medical departments, and the number of PRBC received by condition.
- Application of the calculation of the need for blood model according to PAHO recommendations using ICD-10 in the transfusion service of Hospital La Trinidad of the municipality of Estelí during the study period.

Methodological Framework

- **Type of Study:** A descriptive, observational, cross-sectional study was conducted in the transfusion services of Hospital San Juan de Dios and Hospital La Trinidad of the municipality of Estelí in June, July, and August 2009.

- **Universe and Sample:** The universe was made up of all patients that received transfusions with PRBC in the different medical and surgical de partments of Hospital San Juan de Dios and Hospital La Trinidad of the municipality of Estelí in June, July, and August 2009.
- **Inclusion Criteria:** All patients that received transfusions with PRBC by medical order with a transfusion request completed in the transfusion services of the hospitals studied were included in the study. (*Source: Morbidity Sheet, Statistics Department. Hospital Estelí*).
- **Exclusion Criteria:** All patients that received transfusion with another blood component such as fresh frozen plasma, whole blood, cryoprecipitate, or platelets, whose request was completed in the transfusion services of Hospital San Juan de Dios or Hospital La Trinidad of the municipality of Estelí were excluded from the study (*Source: Morbidity Sheet, Statistics Department. Hospital Estelí*).
- **Data Collection Instruments:** For performance of the study, information was obtained from the transfusion request, recording and monitoring form provided by the transfusion service at Hospital San Juan de Dios and Hospital La Trinidad of the municipality of Estelí. The patient's medical record was reviewed if the form did not indicate the patient diagnosis (*Source: Morbidity Sheet, Statistics Department. Hospital Estelí*).
- **Processing and Analysis:** The data acquired was transferred to previously prepared input tables, which facilitated creation of databases. These were used for subsequent statistical analysis with the SPSS Version 17 statistical data processing software for Windows (in Spanish). (*Source: Morbidity Sheet, Statistics Department. Hospital Estelí*).

Results

TABLE 1. Transfusion of Red Blood Cells According to Medical or Surgical Indication in the Department of Esteli From June to August 2009

INDICATIONS	No. of transfusion recipients (=423)	Average age of transfusion recipients
MEDICAL		
All uses	189 (44.68)	60 (± 28)
Hematological disorders	53 (28.00)	63 (± 28)
Digestive bleeding	72 (38.09)	65 (± 19)
Others	43 (22.75)	60 (± 22)
Neonatal/Exchange transfusion	21 (11.11)	3d (± 2d)
SURGICAL		
All uses	234(55.31)	43 (± 23)
Surgery	76 (32.47)	60 (± 22)
Orthopedics	54 (23.07)	63 (± 22)
Gynecology / Obstetrics	104 (44.44)	30 (±11)
Obstetrics	62 (59.61)	23 (±6)
Gynecology	42 (40.38)	37.5 (±16)

Source: Transfusion form and medical record

TABLE 2. Amount of Packed Red Blood Cells Administered According to Indication in the Department of Esteli from June to August 2009

INDICATIONS	(% of All Units Administered) (=678)	Units Administered x Tx	Average Age of Recipients
MEDICAL			
All uses	283 (41.74)	1.49	60 (± 28)
Hematological disorders	71(25.08)	1.33	63 (± 28)
Digestive bleeding	118(41.69)	1.63	65 (± 19)
Other uses	73 (25.79)	1.69	60 (± 22)
Neonatal exhange transfusion	21 (7.42)	1.00	3d (± 2d)
SURGICAL			
All uses	395 (58.25)	1.68	43 (± 23)
Surgery	122 (30.88)	1.60	60 (± 22)
Orthopedics	93 (23.54)	1.72	63 (± 22)
Gynecology and Obstetrics	180 (45.56)	1.73	30 (±11)
Obstetrics	105 (58.33)	1.69	23 (±6)
Gynecology	75 (41.66)	1.78	37.5 (±16)

Source: Transfusion form and medical record

TABLE 3. Indications for Transfusion of Packed Red Blood Cells According to Age and Specialty from June to August in the Department of Esteli 2009

AGE	INDCACTIONS			TOTAL
	MEDICAL	SURGICAL	GYNECOLOGY AND OBSTETRICS	
0-4	29	0	0	29
5-9	2	0	0	2
10-14	2	0	0	2
15-19	1	7	15	23
20-24	2	3	32	37
25-29	6	12	17	35
30-34	5	4	9	18
35-39	2	4	11	17
40-44	2	1	6	9
45-49	16	11	7	34
50-54	17	12	0	29
55-59	7	6	0	13
60-64	20	11	2	33
65-69	19	20	1	40
70-74	10	2	2	14
75-79	10	6	2	18
80-84	18	14	0	32
85- mas	21	17	0	38
TOTAL	189	130	104	423

Source: Transfusion form and medical record

TABLE 4. * Use of Packed Red Blood Cells in the Population of the Municipality of Esteli and Estimated Need for 2010

AGE	REGIONAL POPULATION 2009	ANNUAL ESTIMATE OF UPRBC 2009	*SPECIFIC AGE USE/YEAR	SPECIFIC AGE USE/10,00 2009	REGIONAL POPULATION 2010	ANNUAL ESTIMATE OF UPRBC 2010	SPECIFIC AGE USE/10,000 2010
0-4	20,291	116	0.0057	57.16	20,676	0.0056	56.10
5-9	24,275	8	0.0003	3.29	24,736	0.0003	32.30
10-14	26,485	8	0.0003	3.24	26,988	0.0003	29.60
15-19	23,194	173	0.0075	74.58	23,635	0.0073	73.19
20-24	21,889	260	0.0119	118.78	22,305	0.0117	116.56
25-29	16,566	228	0.0138	137.63	16,881	0.0135	135.06
30-34	13,291	152	0.0114	114.36	13,544	0.0112	112.22
35-39	12,052	136	0.0113	112.84	12,281	0.0111	110.74
40-44	10,061	56	0.0056	55.66	10,252	0.0055	54.62
45-49	8,222	232	0.0282	282.16	8,378	0.0228	227.69
50-54	6,387	172	0.0252	251.57	6,508	0.0264	264.29
55-59	5,123	88	0.0172	171.77	5,220	0.0169	168.58
60-64	3,916	212	0.0541	541.36	3,990	0.0531	531.32
65-69	3,155	276	0.0875	87.48	3,215	0.0858	858.47
70-74	2,340	84	0.0359	358.97	2,384	0.0352	352.34
75-79	1,803	116	0.0643	643.37	1,837	0.0631	631.46
80- 84	1,178	204	0.1732	1,731.71	1,200	0.1700	1,700.00
85- +	1,320	192	0.1455	1,454.54	1,345	0.1428	1,427.50
TOTAL	201,548	2713		6,200.47	205,375		6,882.04

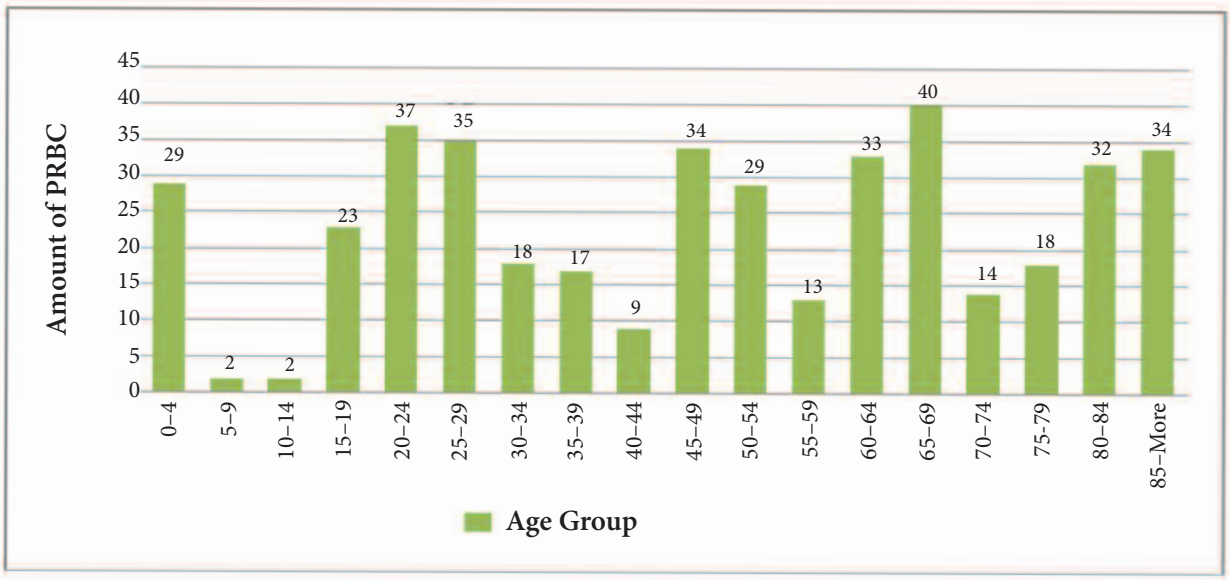
** According to recommendations by Dr. A. Wells*
Source: Transfusion form and medical record

TABLE 5. Transfusion of Packed Red Blood Cells According to Sex and Ward from June to August in the Department of Esteli in 2009

SEX	WARD														TOTAL	
	Internal Medicine		Surgery		Gyneecology		Obstetrics		Pediatrics		Neonatology		Orthopedics			
	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No.	%
Male	86	20.3%	40	9.5%	0	0	0	0	8	1.9%	10	2.4%	37	8.7%	181	42.8%
Female	70	16.5%	36	8.5%	42	9.9%	62	14.7%	4	.9%	11	2.6%	17	4.0%	242	57.2%
TOTAL	156	36.9%	76	18.0 %	42	9.9%	62	14.7%	12	2.8%	21	5.0%	54	12.8%	423	100.0%

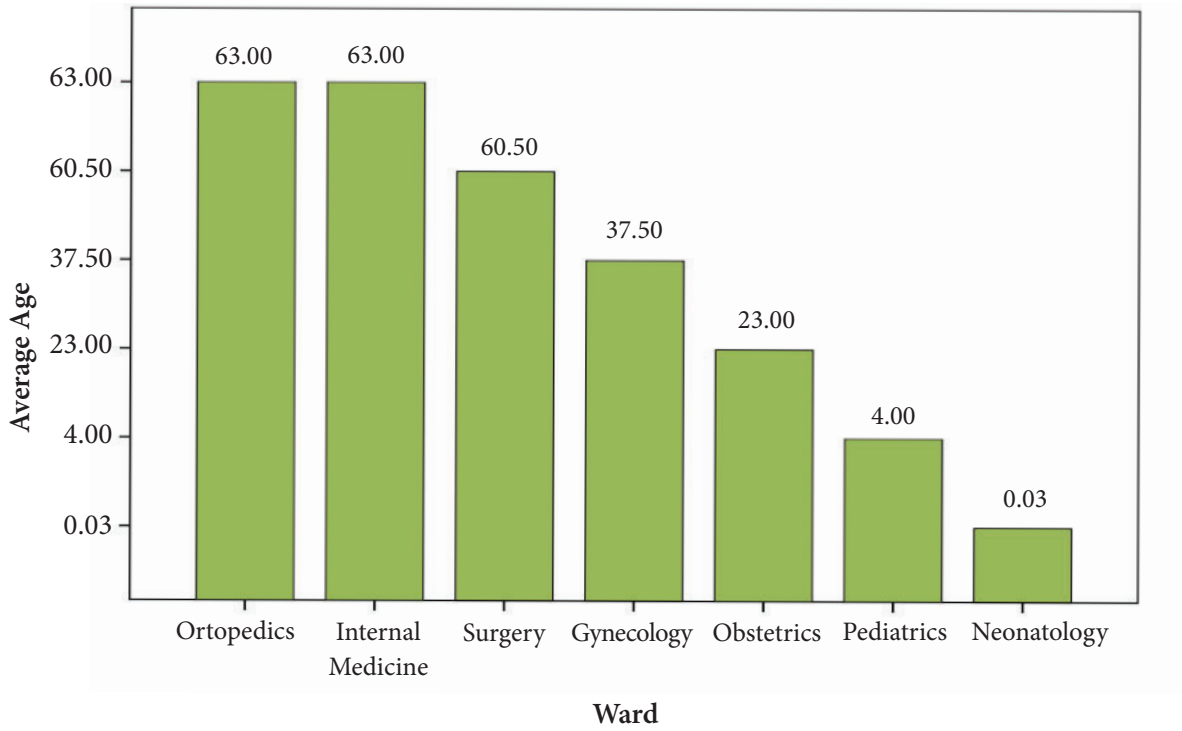
Source: Transfusion form and medical record

Graphic 1. Amount of PRBC Administered from June to August 2009 in the Department of Esteli by Age Group



Source: Transfusion form and medical record.

Graphic 2. Average Age by Ward Where Transfusion of PRBC was Indicated from June to August 2009 in the Deparment of Esteli



Source: Transfusion form and medical record

Conclusions

- In the municipality of Estelí more than half of the patients receive transfusions as a result of surgical indication. Gynecological and obstetric conditions are those that require the most PRBC.
- The sex that receives the most transfusions is female.
- The recipients of PRBC by age group are patients of reproductive age and the elderly.
- The clinical conditions that lead to transfusions the most often are related to pregnancy, childbirth, and the puerperium.
- With the changes forecast in the age structure of the population of the department of Estelí, the demand for PRBC will increase by 11% in 2010.
- The PAHO draft document for estimating the need for PRBC is easy to read, understand, and complete; there are no duplications. We can endorse use of this method because we believe that it is complete and easy to apply, as long as the transfusion service has a database to classify the patients according to ICD-10.

Recommendations

- Promote full completion of the transfusion request and blood component shipment form by the requesting department as well as the personnel from the hospital blood bank (complete and legible data).
- Provide an electronic database to each blood bank of the transfusion service for use of the ICD-10 classification.
- The hospital transfusion committee should define, strengthen, and promote a practical and uniform transfusion standard for each blood component.
- The hospital transfusion committee should ensure and evaluate the rational use of blood and blood components by medical personnel.
- Coordination between the transfusion services (Ministry of Health) and the blood bank (Red Cross) for regular supervision of private transfusion services in order to evaluate the rational and safe use of blood components.

- We suggest that the document for estimating the need for PRBC proposed by PAHO should be more explicit in the calculations in order to determine the future amount for a given population.

Evaluate the Importance of the Matrix for Application of the Calculation of the Need for Blood Components Model in Hospital Victoria Motta of the City of Jinotega from March to August 2009

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Introduction

Blood is essential for saving lives and improving the health of persons. It is a public asset with a high social and economic value. Its social value is related to the fact that it can only be obtained from human donors and the process necessary for acquisition of blood from low-risk populations –completely altruistically and on a regular basis in order to prevent transmission of infections– requires programs that provide for establishment of public policies that implement organization of the services, education of the population, and promotion of the need to achieve an adequate number of donations.

In most of the hospitals in Nicaragua there are difficulties with the lack of availability of blood, particularly in the event of an emergency.

It is not known whether this is due to the fact that the country lacks a policy that requires donation by the population, or there are donors but the system lacks the capacity to appeal to them when they decide to donate and make them voluntary, altruistic, and repeated donors.

The problem of availability of blood applies to all hospital units where transfusions are administered.

Up until this year there were no previous studies of a planning model for blood components that would enable us to guarantee the amount of blood required at the time of an unplanned emergency and evaluate the quality of the blood as well as the most common reasons for transfusion.

Up until this year we did not have guidelines for requests for blood components that would enable us to accurately identify the urgent need for blood components.

Objectives

General Objective: Determine the importance of implementation of this calculation of the need for blood components model in Hospital Victoria Motta.

Specific Objectives:

- Evaluate the accuracy of this model.
- Identify the validity of this method.
- Establish the characteristics that facilitate evaluation of this model in the hospital (validity and accuracy).
- Importance of implementation of this model in our hospital.

Statement of the Problem

- Many hospitals do not conduct satisfactory planning for requests for blood components. The frequency of the urgent need for blood increases each day, and even leads to deaths caused by the lack of blood components in the hospital.
- In general, one of the weaknesses of the blood systems in this region is the lack of availability

of the data required to make such estimates. Therefore, it is necessary to relate the clinical conditions and interventions that require transfusions and their prevalence at the hospital level in different regions of the country by age and sex to the provisions established in the clinical guidelines on the appropriate use of blood components adopted by each country.

Rationale

- Numerous reviews of the clinical indications have shown a high level of variability in the prescription criteria. Therefore, it was necessary to prepare clinical guidelines on the appropriate use of blood as a tool to aid physicians in decision-making for patients that may require a transfusion.
- The preparation and consequent implementation of clinical guidelines should minimize the variations resulting from inappropriate use of the resources (i.e., blood components), which has an effect on patient outcomes and an economic impact on the health system.
- It is necessary to conduct a study of this model that demonstrates whether the quality of care of patients depends on satisfactory planning for requests for blood components.

Methodological Design

Type of Study: The study seeks to evaluate the blood component request form. Therefore, the most important element is not the information on the cases themselves, but rather evaluation of whether the model helps us perform better planning, consequently reducing the morbidity and mortality rates associated with the lack of blood and preventing complications.

Area of Study: Hospital Victoria Motta of the city of Jinotega.

Universe: All patients that received transfusions in Hospital Victoria Motta from March to August 2009.

Secondary Source: Review of data from the blood request forms recorded in the blood bank during this period.

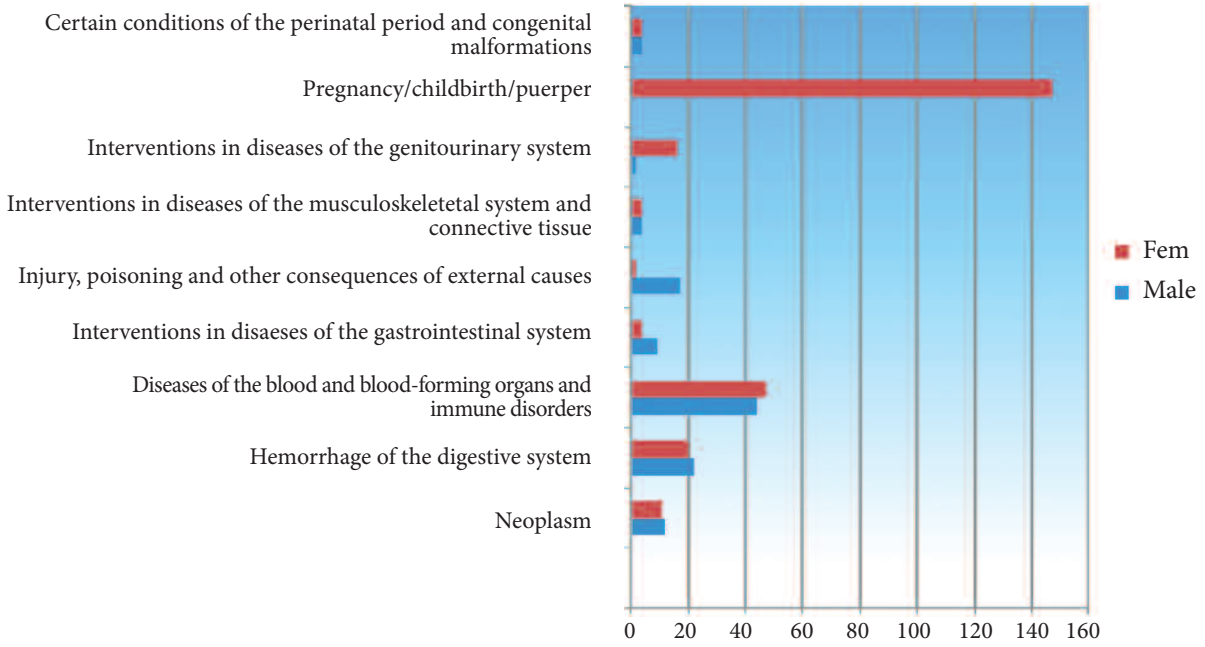
Data Collection Instrument: Blood request forms.

Data Collection Procedures:

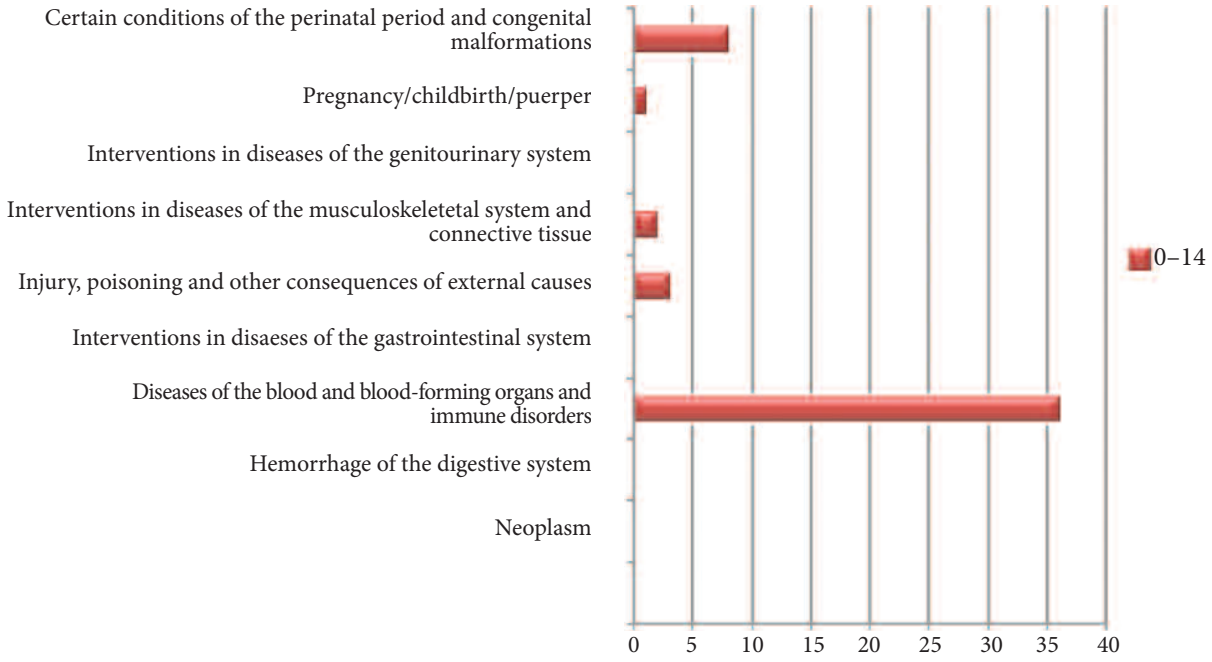
1. The hospital management authorized us to review the blood request forms from March to August 2009.
2. All of the blood request forms submitted during this period were reviewed.
3. A document to record the required information was designed.

RESULTS

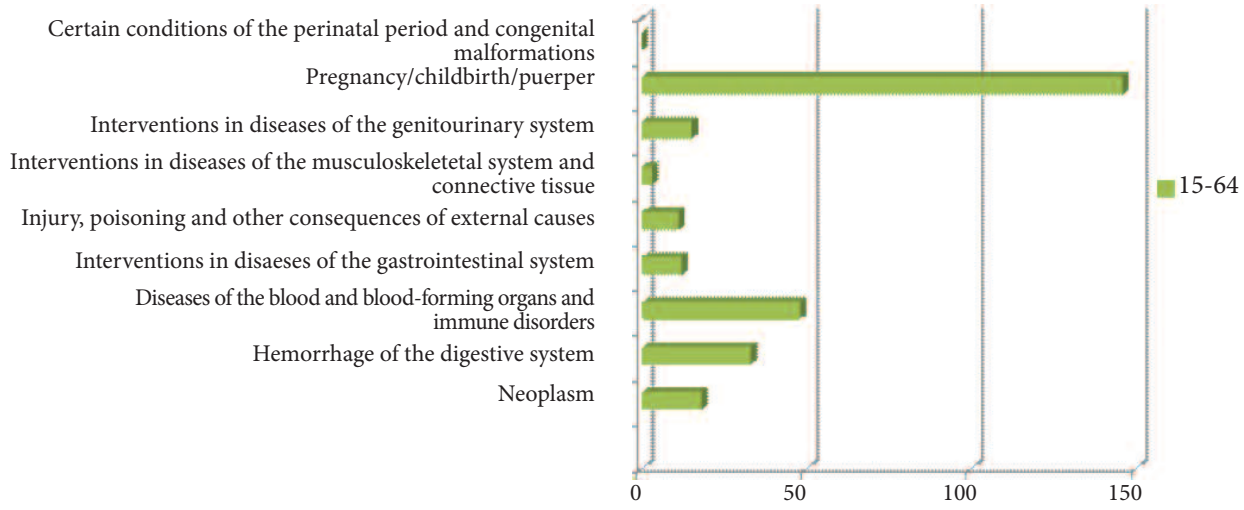
Etiology of Disease by Sex



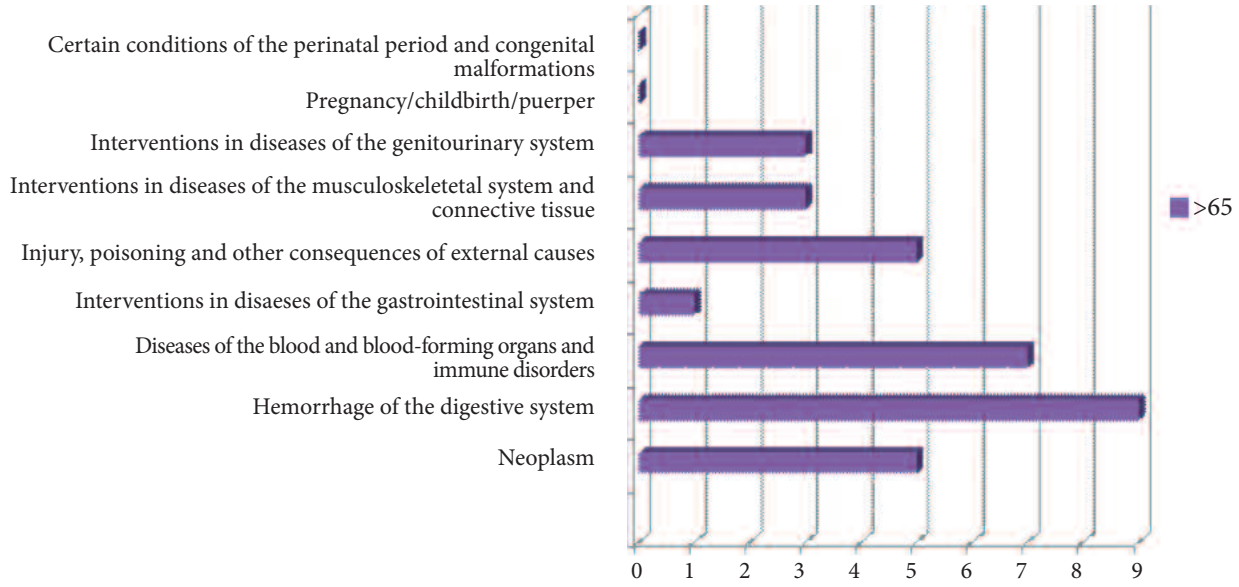
Disease According to Etiology 0-14 years



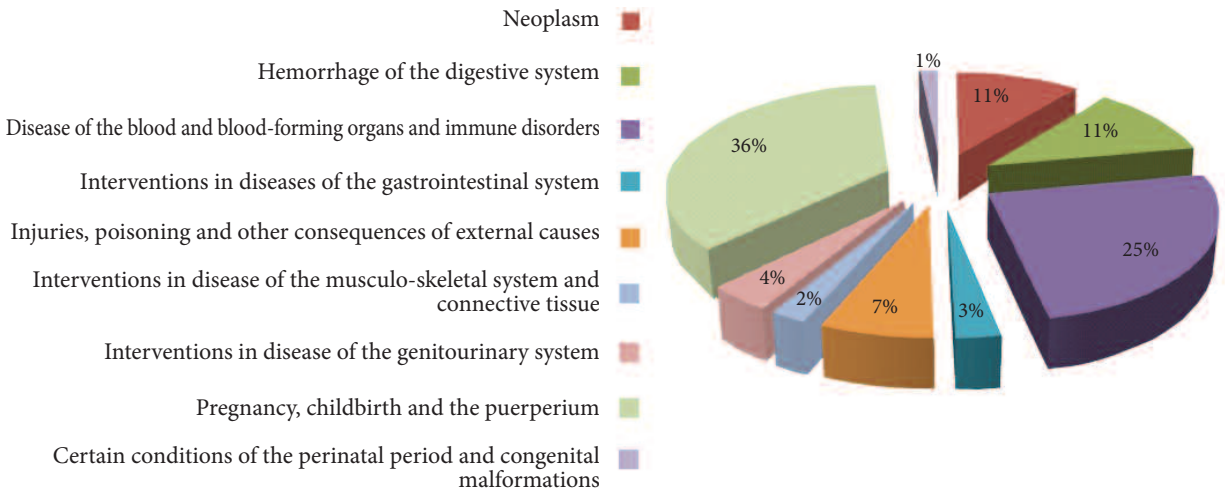
Diseases According to Etiology 15-64 Years



Disease According to Etiology >65 Years



Diseases According to Etiology Percentage of PRBC Used



Analysis

The breakdown is as follows:

Neoplasms: 83 patients were treated; 23 patients (27.7%) received transfusions; 55 UPRBC were used; average of 2.39 units.

Hemorrhages of the Digestive System: 256 patients were treated; 42 patients (16.4%) received transfusions; 58 UPRBC were used; average of 1.38 units.

Diseases of the Blood and Blood-Forming Organs and Immune Disorders: 236 patients were treated; 91 patients (38.5%) received transfusions; 127 UPRBC were used; average of 1.39 units.

Interventions in Diseases of the Gastrointestinal System: 40 patients were treated; 13 patients (32.5%) received transfusions; 14 UPRBC were used; average of 1.07 units.

Injury, Poisoning and Other Consequences of External Causes: 317 patients were treated; 19 patients (6%) received transfusions; 35 UPRBC were used; average of 1.84 units.

Interventions in Diseases of the Musculoskeletal System and Connective Tissue: 87 patients were treated; 8 patients (9.19%) received transfusions; 11 UPRBC were used; average of 1.37 units.

Interventions in Diseases of the Genitourinary System: 155 patients were treated; 18 patients 11.65%) received transfusions; 20 UPRBC were used; average of 1.11 units.

Pregnancy, Childbirth and the Puerperium: 2,094 patients were treated; 147 patients (7.02%) received transfusions; 184 UPRBC were used; average of 1.25 units.

Certain Conditions Originating in the Perinatal Period and Congenital Malformations: 381 patients were treated; 8 patients (2.09%) received transfusions; 8 UPRBC were used; average of 1 unit.

Conclusions

- The advantages and disadvantages of the model for calculation of needs, validation, and evaluation used in the hospital are as follows:

Advantages:

- It is a matrix that is simple to apply and easy to understand.
- It provides rapid and accurate information on the amount of packed red blood cells required in a given period.
- It aids in accurate identification of the diseases that require transfusions most often.
- It aids in planning for the requests for blood components.
- It aids in determining which ward or service provides the most transfusions and whether there are accurate indications for these or they are poorly indicated.
- It enables the hospital transfusion committee to identify how the blood components are being used.
- At the managerial level, it can be used to determine the level of knowledge of the prescribing physicians with regard to the rational use of blood.
- It enables us to recognize errors in the use of blood components.
- It can be used as a method for evaluation of the service responsible for blood transfusions.

Disadvantages

- The matrix does not adapt to the demands of the different hospitals.
- The transfusion request forms are not completed properly in the hospital. The data is incomplete, which prevents satisfactory completion of the matrix evaluated.

Recommendations

- Use the same matrix, but include more conditions that are common reasons for transfusion in most of the hospitals.
- Train the personnel involved in transfusions on completion of this form before introducing it in the health units that administer transfusions.
- It should be a document of general application in all national and international hospitals.
- There should be personnel responsible for ensuring proper completion of this form and follow-up in each hospital.
- The transfusion medicine committee in each hospital should be responsible for proper completion of the blood component request forms.
- Completion of this model should be evaluated on a regular basis in the hospital units where transfusions are administered.
- Each hospital director should be aware of the importance of use of the form so that the transfusion committee supports completion of the form.

Validation of the Recommendations for Estimating the Need for Blood in Hospital Dr. Juan A. Brenes Palacios Somoto, Madriz January-June 2009

R. Ordoñez P., A. Ruiz, R. Cajina Byers

Address: Hospital Dr. Juan A. Brenes Palacios, Somoto, Nicaragua
Phone: 505 272-22-247

Objectives

General Objective: Validate a strategic matrix to determine the blood component requirements in Hospital of Somoto.

Specific Objectives:

- Identify the age groups in which the highest number of transfusions is administered.
- Determine the services that administer the most transfusions in the hospital.
- Identify the blood components that are administered most often.
- Determine the blood group of the persons that receive the most transfusions.

Difficulties Found

- The data in the transfusion log is incomplete.
- There is no order for recording and storage of the medical records.
- There is a lack of trained staff in the statistics department that provides the medical records.
- The transfusion orders do not include a diagnosis.
- Frequent changes in the hospital management.
- Turnover of human resources trained in transfusion medicine.

Results

Table 1

AGE GROUP	FREQUENCY	PERCENTAGE
0-20	44	14.3
21-40	109	35.6
41-60	73	23.9
61-80	47	15.4
81-100	33	10.8
TOTAL	306	100.0

Table 2

HOSPITAL DEPARTMENT	FREQUENCY	PERCENTAGE
SURGERY	40	13.1
CMP	11	3.6
EMERGENCY	3	1.0
GYNECOLOGY	25	8.2
INTERNAL MEDICINE	139	45.4
MATERNITY	70	22.9
ORTHOPEDICS	13	4.2
PEDIATRICS	5	1.6
TOTAL	306	100.0

Table 3

BLOOD PRODUCTS	FREQUENCY	PERCENTAGE
PACKED RED BLOOD CELLS	242	79.1
FRESH FROZEN PLASMA	34	11.1
WHOLE BLOOD	30	9.8
TOTAL	306	100.0

Table 4

BLOOD TYPE AND Rh FACTOR	FREQUENCY	PERCENTAGE
O POSITIVO	214	69.9
A POSITIVO	63	20.6
B POSITIVO	17	5.6
O NEGATIVO	10	3.3
B NEGATIVO	2	0.7
TOTAL	306	100.0

Table 5

BLOOD PRODUCTS	SEX	TOTAL
	F	M
PACKED RED BLOOD CELLS	154	88
FRESH FROZEN PLASMA	14	20
WHOLE BLOOD	27	3
TOTAL	195	111

Conclusions

The matrix can provide data on the patterns of the transfusion practice in our hospital that enable us to estimate our needs. However, it is necessary to train the medical personnel that prescribe transfusions so that they acquire knowledge of and apply the proper indications when prescribing blood based on the appropriate diagnoses. Discontinue the practice of transfusion of whole blood.

Recommendations

- Form the transfusion committee at our hospital.
- Train all medical personnel on transfusion medicine.
- Estimate the need for blood by the criteria of the hospital specialties.
- Do not use whole blood in the absence of well-defined scientific criteria or as a first choice for transfusion.

Blood Discarded by Type (ml)

TYPE	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	TOTAL
O+	500	500	1,750	500	1,250	0	4,500
O-	0	1,000	0	500	250	0	1,750
A+	1,000	500	750	250	250	0	2,750
A-	500	1,500	0	750	0	0	2,750
B+	0	1,000	500	500	750	250	3,000
B-	0	0	0	0	0	0	0
AB+	500	1,000	750	0	500	0	2,750
AB-	0	0	0	0	0	0	0
TOTAL	2,500	5,500	3,750	2,500	3,000	250	1,7500

Blood Received by Type (ml)

TYPE	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	TOTAL
O+	14,000	8,000	11,750	3,000	6,500	9,250	52,500
O-	2,000	500	2,750	0	500	500	6,250
A+	7,500	3,500	3,500	0	4,250	3,250	22,000
A-	1,000	500	500	0	500	1,250	3,750
B+	3,500	1,250	3,000	0	2,000	1,250	11,000
B-	500	250	1,000	0	0	0	1,750
AB+	500	250	500	0	250	0	1,500
AB-	0	0	0	0	0	0	0
TOTAL	29,000	14,250	23,000	3,000	14,000	15,500	98,750

Need for Blood components in Hospital Bertha Calderón Roque in May 2009

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> *"Never walk on the traveled path, because it only leads you where the others have been"*
>
> *Alexander Grahan Bell*
> *1847-1922*

Objectives

General Objective: Determine the need for blood components in Hospital Bertha Calderón Roque in May 2009.

Specific Objectives:

- Determine the general sociodemographic data.
- Determine the location of patients by department.
- Identify the conditions that receive transfusions and the ICD-10.
- Identify the criteria for transfusions.
- Classify the patients in: surgical, obstetric, or neonatal.
- Identify the transfusions and/or intervention cancelled.

Nicaragua, population	5,785,846 inhabitants
Managua	1,817,096 inhabitants
Hospital Bertha Calderón is a national reference	
Admissions 1st sem 2009	11,279 patients
Admission in May	1,879 patients
Transsfusions 1st sem	4,152 units
Transfusions in May	674 transfusions
Units of packed red blood cells	470 units

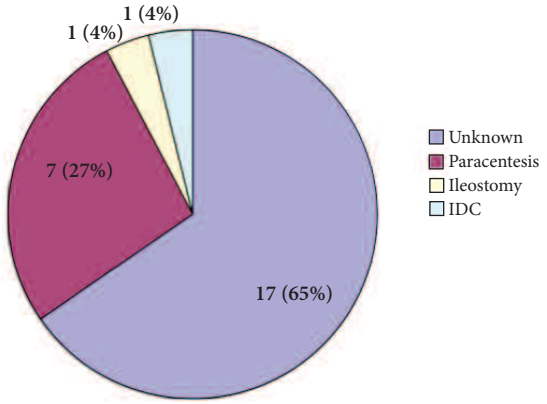
Retrospective, cross-sectional study
Hospital Bertha Calderón
Received blood components
List of recipients
Form completed
Manual processing

> *"The average person puts only 25% of his energy and ability into his work. The world takes off its hat to those who put in more than 50% of their capacity, and stands on its head for those few and far between souls who devote 100%".*
>
> *Andrew Carnegie*
> *1835–1919*

Admission to Different Departments of Hospital Bertha Calderón Roque in May 2009

		Department	Emerg	Ext C	Total
Oncological		Oncology	42	222	264
264	(14.1%)				
		High Obstetric Risk	541	73	614
		Puerperium	13	30	43
1307	(69.6%)	L and D	230	-	230
		Pre labor	65	-	65
		ICU	16	-	16
		S/O	136	-	136
		Complications	203	-	203
Gynecological		S/O	4	-	4
		ICU	1	-	1
118	(6.2%)	Gynecology	50	63	113
		Neonate	190	-	190
190	(10.1%)				
1879	100%	TOTAL	1491	388	1879

Figure Plasma Transfusion Criteria in Departments of Hospital Bertha Calderón Roque in May 2009



Age of Patients Admitted to Departments of Hospital Bertha Calderón Roque in May 2009

Age	Emergency		Ext C
	#	%	
Neonate	190	12.7	0
13 - 14 years	14	1	Sd
15 - 16 years	1234	82.8	Sd
65 - over	15	1	Sd
No data	38	2.5	Sd
Total	1491	100	388

Figure Blood Components Administered in Hospital Bertha Calderón in May 2009

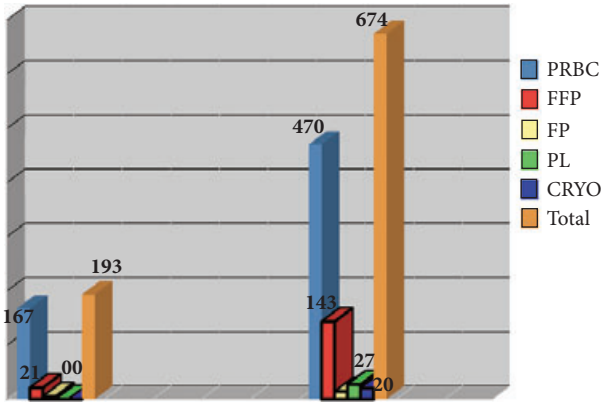


Figure PRBC Transfusion Criteria in Hospital Bertha Calderón Roque in May 2009

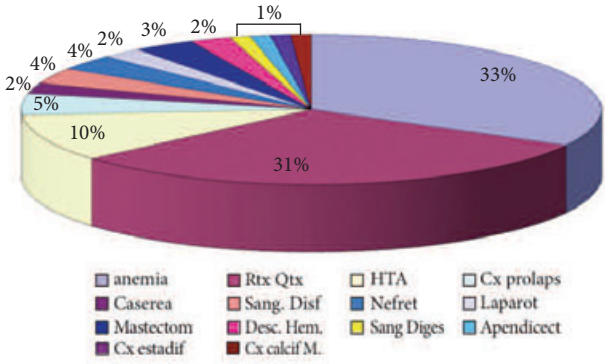


Table Neoplasms

ICD-10 Patients Recipients of PRBC	% Cases Transf	15 - 64	>65	No. of Units Used
2 Breast cancer C50	34%	2	0	89 out of 264 (34%) received transfusions and total consumption= 168 UCG
3 Breast cancer mastectomy		2	1	
26 Uterine cancer C55		24	2	
3 Cervical cancer hysterectomy C55	1.9UPRBC	3	0	
5 Ovarian cancer C56	10UPL	2	3	
1 Ovarian cancer exploratory laparotomy C56	2UFP	1	0	35 UFFP
		2	0	
3 Endomentrial cancer	3.9UFFP	1	1	6 UFP
1 Endometrial cancer staging surgery				
		1	0	10 UPL
* 1 Stomach cancer C16				
		2	1	
3 Pelvic tumor				
41 PATIENT RECORDS COULD NOT BE LOCATED				

Table Pregnancy, Childbirth and the Puerperium. 890 Deliveries. 374 Cesarean Sections

ICD-10 Patients Recipients of PRBC	% Cases Transf	15 - 64	>65	No. of Units Used
8 Postcesarean O 82 2 Cesarean O 82	2.3 UPRBC	8 2	0 0	99 out of 1307 (7.6%) received transfusions
3 Post-abortion O 07.6 3 Postpartum O 80	17 UPL 20 UCRYO	3 3	0 0	226 UPRBC
4 Pregnancy		4	0	81 UFFP
1 Premature detachment of placenta O 80	2.3 UFP 4.5 UFFC	1	0	17 UFP
1 Edampsia		1	0	17 UPL
77 PATIENT RECORDS COULD NOT BE LOCATED				20 UCRYO

Table Gynecological Conditions

ICD-10 Patients Recipients of PRBC	% Cases Transf	15 - 64	>65	No. of Units Used
5 Myonmas D25 6 Hysterectomy for myoma D25	1.4 UPRBC 2 UFFP	5 6	0 0	47 out of 118 (39.8%) received transfusions
2 Colpoplant for pelvic prolapse 1 Post surgical pelvic prolpse 2 Surgery for rectocele		0 1 1	2 0 1	65 UPRBC
3 Dysfunctional bleeding		3	0	6 UFFP
1 Endometrial hyperplasia		1	0	
1 Breast calcifications		1	0	
26 PATIENT RECORDS COULD NOT BE LOCATED				

Table Neonatal Conditions

ICD-10 of Patients Recipients of PRBC	% Cases Transf	15 - 64	>65	No. of Units Used
NO RECORD COULD BE LOCATED, but 15 neonates received transfusions, 9 of them received PRBC and 9 received FFP Source: Laboratory Service	1.2 UPRBC 2.4 UFFP			15 OUT OF 190 (7.9%) Neonates admitted; 33 units used. 11 UPRBC 22 UFFP

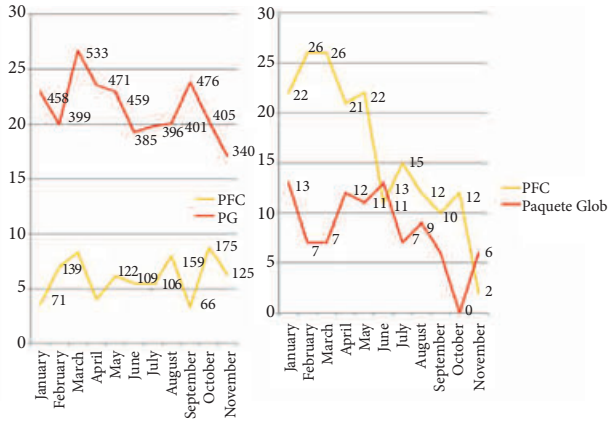
Conclusions

- Individual consumption by department is highest in the oncology department: 36% packed red blood cells, 32% all blood components, and 34% admissions.
- Obstetric conditions are the main reason for transfusion of blood components, primarily packed red blood cells (48%). They have the highest average consumption per patient with 2.3 units. However, since it is the main condition for admission, the patients receiving transfusions represent only 7.6% of the total patients admitted.
- Patients with gynecological conditions that receive transfusions account for 14% of the use of packed red blood cells. It is noteworthy that nearly 40% of the patients admitted receive transfusions.
- In 33% of the 88 medical records reviewed, the reason for transfusion is the hematocrit level. There are less cases with a clinical rationale for fresh frozen plasma. In 65% of the cases the clinical rationale is not considered.
- A total of 89% of the patients are in the 15- to 65-year-old range according to the hospital profile.

Recommendations

- Proper completion of the transfusion monitoring form.
- Performance of a prospective study to evaluate the need for blood in Hospital Bertha Calderón.
- Knowledge of the clinical guidelines on use of blood and blood components by medical and paramedical personnel, and proper application of the guidelines.
- Train personnel on the importance of optimal use of blood and blood components.
- Urge the transfusion committee to maintain continuous monitoring of fulfillment of the clinical guidelines.

"The greater the difficulty, the more the glory in surmounting it."



Evaluation of the Need for Blood and Blood Components in Hospital César Amador Molina of Matagalpa from 1 January to 31 July 2009

C. Guido López, A. M. Blandón Aguirre, E. J. Zeledón Contreras

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Teléfono: 2772-2115

Introduction

Rationale: The purpose of this study is to determine the situation and evaluate the need for blood and blood components in Hospital César Amador Molina (HCAM) of Matagalpa, Nicaragua in the first semester of 2009. It also seeks to validate the simplified model in order to ensure fulfillment of the objectives and strategies currently required for development of transfusion medicine, guaranteeing the safety of transfusion.

Objectives

General Objective: Determine and evaluate the need for blood and blood components in HCAM of Matagalpa, Nicaragua from 1 January to 31 July 2009.

Specific Objectives:

- Propose validation and evaluation of the model for estimating the need for blood and blood components in HCAM of Matagalpa.
- Determine the total number of patients that received transfusions by age and sex in HCAM of Matagalpa from 1 January to 31 July 2009.
- Determine the number of transfusions, the reason for the transfusions, and the type of blood components administered in HCAM of Matagalpa from 1 January to 31 July 2009.

Methodology

- **Type of Study:** Descriptive, longitudinal study conducted from 1 January to 31 July 2009.

- **Area of Study:** The study was conducted in HCAM, which is located in the central region of Nicaragua, in the department of Matagalpa. The patients considered in the study all received transfusions in the different hospital wards: internal medicine, with 30 beds; gynecology/obstetrics, with 46 beds; pediatrics, with 180 beds divided into the different pediatric specialties, including the neonatology and pediatric emergency rooms; adult emergency ward, with 10 beds; orthopedics, with 30 beds; surgery, with 27 beds and an operating room.

- **Study Population:** All patients that received transfusions of blood or blood components from 1 January to 31 July 2009 in HCAM of Matagalpa, Nicaragua. A total of 1,099 patients received transfusions.

- **Case Definition:** All patients that received transfusions from 1 January to 31 July 2009 were considered to be cases.

Inclusion Criteria:

- Both sexes
- All ages
- Received transfusion with blood or a blood component.
- Fulfills the case definition
- In the study period.

Exclusion Criteria: Failure to fulfill the case definition.

Data Collection Instrument: The calculation of the need for blood and blood components model was used. Data was taken from the log and the medical records.

Source of Data: Secondary source of data based on the medical records. The blood bank log and the medical records of HCAM of Matagalpa were reviewed.

Data Collection Procedure: All patients that received transfusions with blood or a blood component from 1 January to 31 July 2009 in HCAM. The information was collected from the medical records and the blood bank log.

Ethical Aspects: Authorization for enrollment in the study was not requested, since it is a study with data from 1 January to 31 July 2009. It was ensured that the information obtained is for study purposes. In addition, authorization was requested from the management. The purpose of the study is to validate the simplified model in order to be able to estimate the need for blood and blood components in HCAM of Matagalpa. The benefit obtained will be calculation of the future needs taking into account the expansion of new departments, increased number of beds, and introduction of new technologies.

Plan for Analysis: An Excel spreadsheet was created for the data obtained. The results were processed and analyzed. The data was presented in figures and tables. The percentages of the quantitative and qualitative variables were estimated.

Results and Discussion

Table No.1: Percentage distribution by age and sex of transfusions administered in HCAM, Matagalpa. January-July 2009.

Age	Sex		Total	
	F	M	No.	%
< 14 years	219 (20 %)	77 (7 %)	296	27 %
15 – 64 years	473 (43 %)	264 (24 %)	737	76 %
> 65 years	33 (3 %)	33 (3 %)	66	6 %
Total	**725 (66 %)**	**374 (34 %)**	**1099**	**100 %**

Source: Blood bank file.

Table No. 2: Monthly consumption of whole blood by blood type in HCAM, Matagalpa. January-July 2009.

Ward	Indication	No.	%
Internal Medicine	1. Neoplasm	5	4.8
	2. Anemia	6	5.8
	3. Kidney disease	4	3.8
	4. Septic shock	1	1.0
	5. STDA	7	6.7
General Surgery	1. Trauma (hipoyolemia)	3	2.9
	2. Neoplasm	5	4.8
	3. Septic shock	4	3.8
Gynecology Obstetrics	1. Neoplasm	5	4.8
	2. PPH	20	19.2
	3. Pregnancy and anemia	7	6.7
	4. Miomatosis	1	1.0
Orthopedia	1. Neoplasms	1	1.0
	2. Fracture	9	8.7
	3. Trauma	6	5.8
Pediatric	1. Exchange transfusion	1	1.0
	2. Neoplasm	1	1.0
	3. Septic shock	15	14.4
	4. DN and anemia	2	2.0

Source: Blood bank file.

Table No. 3: Monthly consumption of fresh frozen plasma by blood type in HCAM, Matagalpa. January-July 2009.

Month	Group and Rh				Total
	O +	A +	B +	O -	
January	12%	3 %	0.4 %	1 %	16.4%
February	11 %	2 %	1.3 %	-	14.3%
March	13 %	2 %	-	-	15%
April	18 %	2 %	0.8 %	0.4 %	21.2%
May	19 %	4 %	-	0.4 %	23.4%
June	4 %	1 %	1.3 %	-	6.3%
July	3 %	0.4 %	-	-	3.4%
Total	80 %	14.4 %	3.8 %	1.8 %	100 %

Source: Blood bank file.

Table No. 4: Monthly consumption of fresh frozen plasma by blood type in HCAM, Matagalpa. January-July 2009.

Month	Group and Rh			Total
	O +	A +	B +	
January	13.7 %	2.5 %	-	16.2 %
February	3.4 %	2.9 %	-	6.3 %
March	10.4 %	1.4 %	-	11.8 %
April	12.9 %	6.6 %	-	19.5 %
May	13.6 %	2 %	-	15.6 %
June	9.2 %	1 %	1 %	11.2 %
July	17.4 %	1.2 %	1 %	19.6 %
Total	80.5 %	17.5 %	2 %	100 %

Source: Blood bank file.

Table No. 5: Monthly consumption of PRBC by blood type in HCAM, Matagalpa. January-July 2009.

Month	Group and Rh							Total
	O +	A +	B +	O -	A -	B -	AB +	
January	6.8 %	2.7 %	0.4 %	0.7 %	0.3	-	-	10.9 %
February	8.4 %	0.9 %	1.1 %	-	-	-	-	10.4 %
March	9.8 %	-	-	-	-	-	-	9.8 %
April	14.9 %	3.9 %	1 %	0.2 %	-	0.3 %	0.2 %	20.5 %
May	11.4 %	5 %	1 %	0.3 %	-	-	-	17.7 %
June	10	3.2 %	0.7 %	0.3 %	-	-	-	14.2 %
July	12.6 %	2.9 %	0.5 %	0.5 %	-	0.01 %	-	16.5 %
Total	73.9 %	18.6 %	4.7 %	2 %	0.3 %	0.3 %	0.2 %	100 %

Source: Blood bank file

Figure No. 1: Percentage distribution by age and sex of transfusions administered in HCAM, Matagalpa.

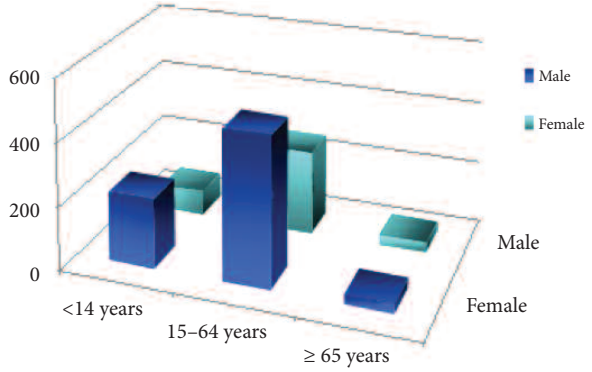


Figure No. 2: Monthly consumption of whole blood by blood type in HCAM, Matagalpa. January-July 2009.

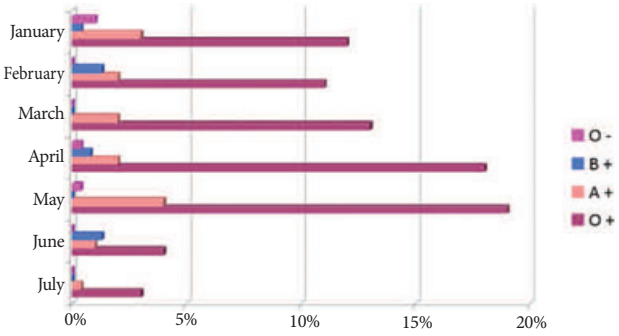


Figure No. 3: Monthly consumption of FFP by blood type in HCAM, Matagalpa. January-July 2009.

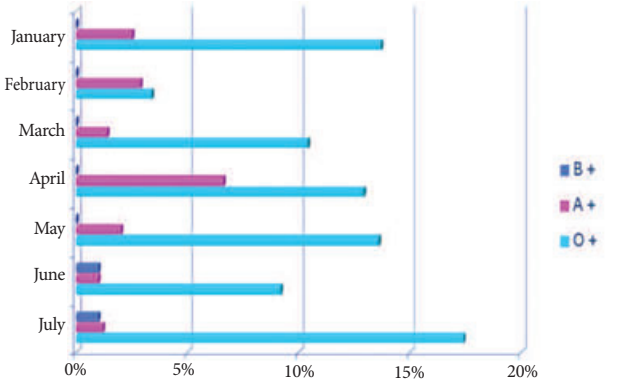
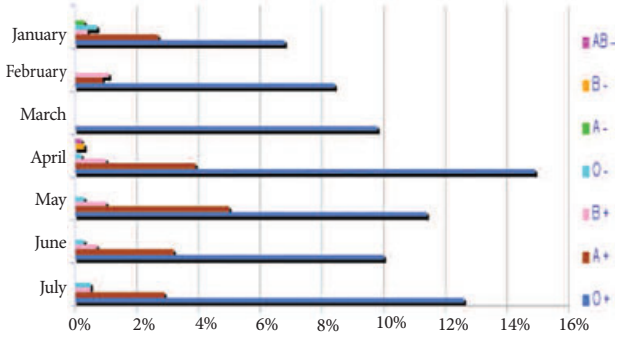


Figure No. 4: Monthly consumption of PRBC by blood group in HCAM, Matagalpa. January-July 2009.



Limitations of the Study

- The database was not completed and many records had to be reviewed in a short period of time.
- We were given a short period of time for research. This did not allow us to evaluate whether the transfusions were based on the guidelines for rational use of blood, taking into account the cost of the blood for the hospital.
- Another limitation is that in our hospital the diseases are not coded adequately and as requested for implementation of the document provided by PAHO.

Conclusions

- The medical personnel did not record the reason for indication of the transfusion in 90.5% of the cases. The indication of the transfusion was only recorded in 9.5% of the cases.
- The total number of transfusions administered in the study period was 1,099. The female population received more than the male population (66% vs. 34%, respectively).
- The predominant age is over 15 years and under 65 years.
- The blood component used most often was packed red blood cells. The second most common product indicated was whole blood.
- April and May were the months with the highest consumption of packed red blood cells (20.5% and 17.7%, respectively) and whole blood (21.2% and 23.4%, respectively).
- The ward that recorded the highest consumption of blood components was gynecology/obstetrics (32%), followed by internal medicine (22.1%).
- The main reasons for indication of transfusion were anemia (33.7%) and septic shock (19.2%).

Recommendations

- Establish the transfusion committee immediately with the unconditional support of HCAM authorities.
- The rational use of blood and blood components should be evaluated according to the standards. Therefore, implementation of the simplified model developed by PAHO is proposed, which facilitates preparation of detailed estimates of the need for blood in HCAM of Matagalpa.
- Thorough completion of the transfusion form in the database for each patient.
- Proper completion of the recording form in the blood bank of HCAM of Matagalpa.

Analysis of the Situation of Transfusion of Packed Red Blood Cells in Hospital de San Carlos Río San Juan

N. Ruíz García

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Phone: 505 25-83-0244

Introduction

Description of Department

RIO SAN JUAN
Location:
- Southeastern Nicaragua

Population:
- 107,545 inhabitants
  - 6 municipalities
  - 279 localities

CLIMATE:
- Tropical humid
- Rain for 8 to 11 months

ACCESS ROUTES OF THE DEPARTMENT

ACCESS ROUTES TO THE DEPARTMENT

ACCESS ROUTES TO THE DEPARTMENT BY LAKE

HOSPITAL DR. LUIS FELIPE MONCADA

SERVICES
- Gynecology/Obstetrics
- Pediatrics
- Surgery
- Orthopedics
- Internal Medicine
- Anesthesiology
- 36 registered beds
- 68 actual beds

MEDICAL PERSONNEL
- 7 MSS
- 7 General Medicine
- 7 Surgical Medicine
- 2 Non-Surgical Medicine
- 2 Anesthesiologists

TRANSFUSION CENTER LABORATORY

HOSPITAL TRANSFUSION COMMITTEE

History

There is no history or record of studies conducted in our area to analyze the situation of blood transfusion. There is no document for data collection that uses inputs for analysis, evaluation and calculation of the need for blood components in the different health units in the country where transfusion services are provided to the general population.

This study seeks to determine the current situation of blood transfusions in Hospital de San Carlos, Río San Juan.

Rationale

Although transfusion of units of packed red blood cells is often indicated in the hospitals in Nicaragua, records of the blood components, transfusions, and recipients are lacking or insufficient. Therefore, it is considered to be essential to evaluate the current situation of these practices in the different services of our hospital units as these are very high-risk practices that can cause adverse reactions, infections, and even death of the recipients. This will be determined by completion and subsequent analysis of the calculation of the need for blood components model, the blood component request form, and the transfusion log, which will provide important data for future analysis and decision-making, and enable us to improve these practices.

Statement of the Problem

What is the current situation with regard to transfusion of packed red blood cells in Hospital Dr. Luís Felipe Moncada of San Carlos, Río San Juan from January to June 2009?

Objectives

General Objective: Determine the situation with regard to transfusion of packed red blood cells in Hospital Dr. Luís Felipe Moncada, San Carlos, Río San Juan, January-June 2009.

Specific Objectives:

- Identify the demographic characteristics and health of the patients that received transfusions with packed red blood cells.
- Determine the amount and the average number of units of packed red blood cells administered.
- Determine the validity of the matrix for the calculation of the need for blood components model.

Methodology

Type of Study: Descriptive, retrospective.

Research Design: Non-experimental, cross-sectional, descriptive.

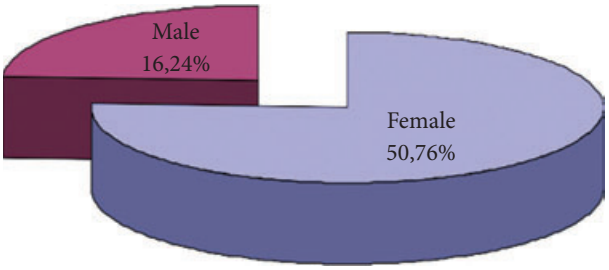
Area of Study: Transfusion service of Hospital Dr. Luís Felipe Moncada, San Carlos, Río San Juan.

Study Sample: Patients admitted to the different hospital services with indication of transfusion of packed red blood cells.

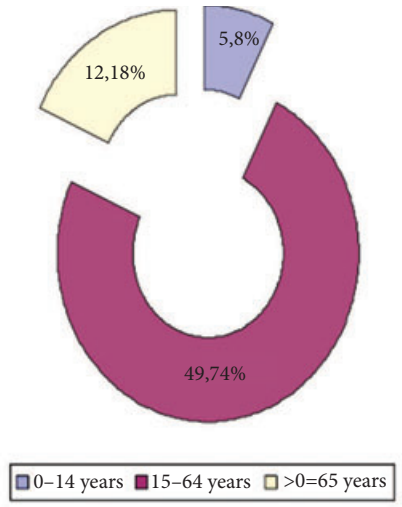
Plan of Analysis: Matrix of the model for estimating the need and processing in output tables.

Results

Transfusions of UPRBC by Sex in HLFM, January-June 2009

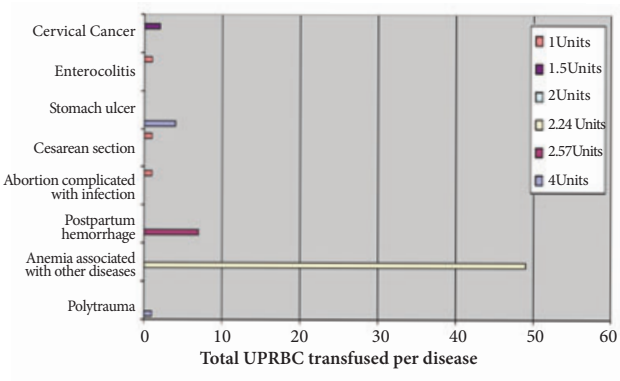


Transfusion of UPRBC by Age Group in HLFM, January-June 2009



Results

Average Number of UPRBC Administered by Biology in HLFM, January-June 2009



Conclusions

- The sex that received the most transfusions was female (76%) and less frequently, male (24%).
- The age group with the most transfusions was 15 to 64 years (74.24%). The group with the least transfusions was 0 to 14 years of age (7.57%).
- The leading cause of transfusion was anemia associated with other diseases (74.24%). The least frequent cause was polytrauma (1.5%).
- Gastric ulcers required the most UPRBC (4 units). Caesarean section and abortion required the least (1 unit).
- The average number of UPRBC administered was 2.3 units per patient, 25.3 units per month, and 152 units per semester.
- The model is considered to be a practical, simple, and useful tool for analysis and calculation of the need for blood components. Implementation is considered to be necessary as long as it is supported by the national and local authorities, in order to reinforce all of the strategies implemented with the aim of improving the transfusion service. Without such support, the model or any other means, strategy, or data collection form, regardless of how well it is implemented, would not be used to achieve our objectives and would only be another document in our hospital wards.

Recommendations

- Better planning and management of the national blood system network.
- Assignment of technological and human resources in each transfusion center on an ongoing basis, as well as improvement and modernization of the centers.
- Establishment of transfusion committees in all health units where transfusion services are provided for blood components.
- Training of local basic health program (SILAIS) personnel on monitoring of transfusion centers.

- Improve the communications and supply network for blood components, particularly in the units that are difficult to access and are located far from the national blood center.
- Completion of the calculation of the need for blood components document by personnel trained in transfusion medicine.
- Issue new diplomas to health workers that are members of the transfusion committees, mainly in the units where only one resource has been trained due to the cost involved in training and the remoteness of the area. This should not be a reason for taking it into account less. Rather, it should be assigned higher priority since in these units is where more attention is required as a result of their specific traditional characteristics of being overlooked and given less attention by the governments.
- Guarantee and have available all stationery that is required to collect and record information on the entire blood transfusion process.
- Include the unit of analysis of 65 years (≥ 65 years) in the validation document.
- Add the blood group variable (ABO, Rh).

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