EDORIUM Journals

Int J Blood Transfus Immunohematol 2022;12(2):12–20.
www.ijbti.com

RESEARCH ARTICLE PEER REVIEWED | OPEN ACCESS

Challenges facing blood transfusion services at a regional blood transfusion center in Western Kenya

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ABSTRACT

Aims: The demand for blood and blood products in sub-Saharan Africa is occasioned by tropical infectious diseases and obstetric complications that cause anemia. We therefore need a well-organized blood transfusion service with sufficient resources to process blood and blood products, especially in the Western Kenya, where co-infections of tropical diseases are rampant. This study was aimed at determining the blood deficiency and challenges experienced by Eldoret Regional Blood Transfusion Center (ERBTC).

Methods: A cross-sectional descriptive design was used to conduct the study. All the ERBTC staffs, donor records, and blood requisition and dispatch registers were studied. Self-administered questionnaires and data collection abstraction forms were used to collect data. The extracted data from ERBTC registers included those on demand and supply mismatches and blood discards. The obtained data were entered into Microsoft Excel and analyzed using descriptive statistics.

Results: A total of 16 staffs, 230 donor records, and 9612 units of requested blood were reviewed. The ERBTC reported many challenges ranging from understaffing, limited funding, insufficient equipment, and irregular reagents and other laboratory supplies. During the study period, the blood bank only managed to supply 4740 units of blood against a demand of 9612 units, thus occasioning a 50.7% deficit. A discard rate of 7.8% after the screening was also reported due to insufficient volumes after collection and transfusion transmissible infections. However, there were no wastages during the study period.

Conclusion: The main challenges experienced by ERBTC were understaffing, insufficient funding, limited equipment, frequent reagent outages, and discards of unsuitable blood, resulting in very high deficits. We recommend hiring staff, increased funding, acquiring modern equipment and reagents, and recruiting known regular blood donors to alleviate frequent shortage.

Keywords: Demand, Equipment, Reagents, Supply

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Received: 19 May 2022
Accepted: 12 August 2022
Published: 12 October 2022

How to cite this article

Kavulavu BM, Bushuru BN, Muendo NN, Kumotia WO, Kipkulei JC, Lotodo TC, Kirinyet JK, Tum F, Obala A. Challenges facing blood transfusion services at a regional blood transfusion center in Western Kenya. Int J Blood Transfus Immunohematol 2022;12(2):12–20.

Article ID: 100075Z02KM2022

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doi: 10.5348/100075Z02KM2022RA

INTRODUCTION

Although blood transfusion is a life-saving medical intervention, this vital service faces numerous challenges due to blood shortages, inadequate allocation of funding for blood transfusion processes, and the overall community reluctance to donate blood, according to Chevalier et al. [1]. Allogenic blood is in high demand as approximately one million units are needed for transfusion in Kenya per year [2]. However, the increased demand for blood in medical practice has overstretched the available blood supply, thus causing the shortages. Reporting on the impact of the COVID-19 pandemic on blood supply, Loua et al. [3] noted that the present pandemic caused a reduction in blood-related activities in the region, including overall demand and supply of blood components, hence the need for countries to prepare for emergencies and maintain sufficient bloodstock.

Worldwide, blood transfusion faces challenges including the transmission of blood-borne infections, which include HIV/AIDS, hepatitis B and C, Human T Cell Lymph Tropic Virus I and II, syphilis, cytomegalovirus, Epstein–Barr Virus, brucellosis, toxoplasmosis, malaria, leishmaniasis, trypanosomiasis, and others. Osaro and Charles [4] observed that factors such as escalating elective surgery, an aging population, periodic shortages arising from a fall in supply, threat of transfusion-transmissible infections, and spiraling costs because of various safety measures have all conspired to curtail blood supply to the National Health Services.

Kenya's need for blood is ever increasing. Such increasing trends were initially explained by tropical infectious diseases, mainly malaria, which causes severe anemia and necessitates transfusion to save lives. Pedro et al. [5] noted that decreasing prevalence of malaria resulted in a corresponding decline in the demand for blood transfusion, especially among pediatric patients. However, Thomas et al. [6] have observed that malaria-related anemia was still the primary cause of transfusion among pediatric patients, and delays culminated in adverse outcomes. In recent years, trauma-related demand for transfusion has significantly increased, mainly because of motor-cycle and road-traffic accidents [7].

The Kenya National Blood Transfusion Service (KNBTS) is mandated to supply safe and quality blood for transfusion. The workflow at the ERBTC is as shown in Figure 1. However, it is faced with challenges in implementing this mandate as there is a lack of clarity in the legal framework and governance systems of its operation as a division within the Department of Diagnostics and Forensic Services [2]. Kimani et al. [8], in a comparison of voluntary donors (VDs) and family replacement donors (FRDs) in Kenya, explained that VDs presented a lesser risk than FRDs, voluntary blood donation is still limited. These challenges are partly responsible for the inability of KNBTS to supply sufficient blood to meet the national demand of at least 470,000 units annually [9].

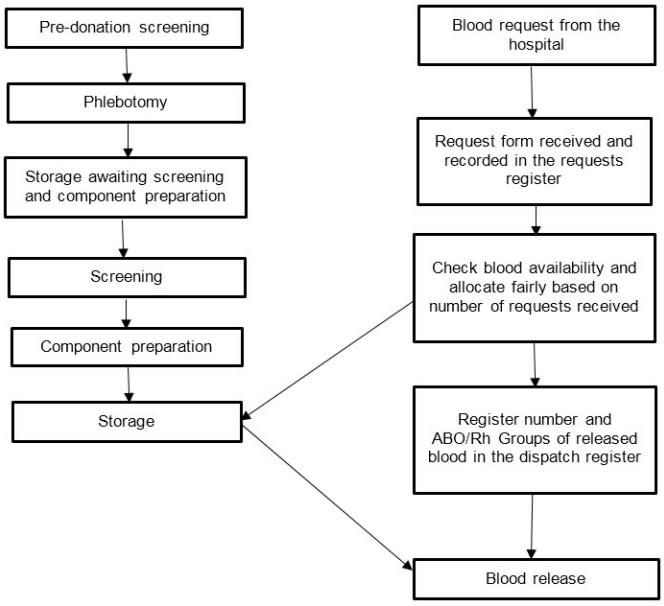

Figure 1: Workflow process at the ERBTC.

There is a significant gap in knowledge regarding the challenges facing transfusion services within the Western region of Kenya, which is served by the ERBTC. Therefore, this research is explicitly tailored to investigate the challenges faced by the ERBTC to inform authorities to address them. To the best of our knowledge, no other study has considered the problems facing the KNBTS and narrowed it down to the ERBTC. This study assessed the specific challenges experienced by KNBTS resulting in acute shortages of blood and blood products in its reserves.

MATERIALS AND METHODS

Study site

The study was undertaken at the ERBTC, located at Eldoret town in Western Kenya. The center collects, processes, and supplies blood and blood components to both public and private hospitals within the Western Kenya region, which has a population of about 16 million.

Study design

A cross-sectional descriptive design was employed.

Study population

The study population was consisted of all staffs working at the Eldoret Blood Transfusion Centre (ERBTC), the donor records, and requisition and supply registers.

Eligibility criteria

The study included all ERBTC's staffs who consented to participate in the study. All staffs who had served at

ERBTC for less than three months or were on leave during the study period were excluded.

Sample size

The number of donors/donations included in the study was calculated using Fisher's formula as used by Mugenda [10].

$n = z^2pq/d^2$

where n = Minimum sample size;

z = Standard normal deviation at the desired confidence interval (1.96);

P = Proportion of population with the desired characteristic, which was the proportion of donor blood units wasted and discarded and was taken to be 18.3% (Chavan, 2017);

q = (1–p);

d = Accepted margin of error/degree of precision (0.05).

Therefore: N = (1.96×1.96×0.183×0.817)/(0.05×0.05) = 230

Sampling method

The Census technique was used to sample all the staffs as well as blood requests and dispatch records. Besides, consecutive sampling technique was used to identify blood donor records between January 1, 2021 and March 31, 2021.

Data collection

Researcher-administered questionnaires were issued to all staff to assess their perceptions on the adequacy of staffing, finances, equipment, and reagents. Data abstraction forms were used to collect data on donor unit wastages and discards from blood donor records and blood demand and supply from the requisition and dispatch registers.

Data analysis and presentation

Data were entered into Microsoft Excel 2016, analyzed using descriptive statistics, and results presented as frequency tables and graphs.

Ethical considerations

The study obtained ethical approval (Approval No. FAN 0003708 of November 25, 2020) from the Joint Moi University and Moi Teaching and Referral Hospital Institutional Research and Ethical Committee (IREC). Verbal consent was obtained from MTRH and MTRH Laboratory Division administration. Informed consent was also obtained from ERBTC staff. Donor or recipient names were not disclosed for purposes of ensuring professional confidentiality.

RESULTS

Socio-demographic characteristics of the respondents

ERBTC staff

Of the 20 questionnaires that were administered to staff, 80% (16/20) questionnaires were completed and returned. The mean age of the respondents was 41.1 years with a range between 32 and 46 years. Most of them were females, accounting for 56.3% (n=9). The laboratory technologists comprised 50% (n=8) as shown in Table 1.

Table 1: Sociodemographic characteristics of ERBTC staff

Characteristic	Frequency (n=16)	Percentage (%)
Age		
31–40	9	56.25
41–50	7	43.75
Sex		
Male	7	43.75
Female	9	56.25
Cadre		
Medical laboratory technologists	8	50
Nurses	2	12.25
IT personnel	1	6.25
Social worker	1	6.25
First aider	1	6.25
Receptionists	3	18.8
Academic qualifications		
Diploma	8	50
Bachelor's Degree	6	37.5
Master's Degree	2	12.5

Blood donors

The average age of blood donors was 31.8 years. The youngest donor was 17 years while the oldest was 61 years. Primarily, the donors were males, accounting for 77.8% (n=179). Blood group O Rhesus positive was the most commonly donated blood, accounting for 40.9% (n=94) of the total collected units at the ERBTC during the study period, followed by A Rhesus positive at 27.4 (n=63). Figure 2 shows the distribution of the donors and blood groups.

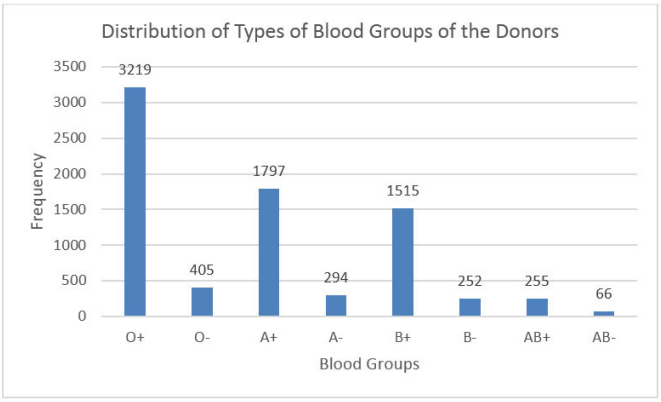

Figure 2: Distribution of types of blood groups of the donors.

Human resource, finances, equipment, and reagents

ERBTC staff

The first aider, social workers, receptionists, IT experts, and nurses reported that they were sufficiently staffed for the tasks they performed at the ERBTC. However, 87.5% (n=7) out of the eight Medical Laboratory Technologists deployed at the center lamented that this level of staffing in relation to the workload was insufficient and cannot adequately handle the duties at the ERBTC, for instance, the outreach blood donation programs and the blood and blood products preparations required of them.

ERBTC finances

Of the 16 staff who responded, 62.5% (n=10) stated that the ERBTC did not have sufficient funds for daily operations. In contrast, however, 25% (n=4) believed that the center had sufficient funds, and 12.5% (n=2) did not respond to this question. Of the respondents, 50% (n=8) of staff agreed that the ERBTC received supplies and support from other sources besides the Kenyan government, including NGOs, supermarkets, business people community, and hospitals within Eldoret town.

Equipment and reagents

Four (25%) of ERBTC staff were not able to respond to this question on equipment in service and reagents' supplies. This was probably because they had no technical ability to comprehend the suitability of the equipment and the reagent used at ERBTC. However, 75% (9/12) of staff believed that equipment in service were insufficient and could not cater for the workload at the center. Only 25% (3/12) said the equipment were sufficient for the daily workload at ERBTC. Of the nine (9) staff who believed working equipment were insufficient; 44% (no=4/9) of them were of the opinion that insufficiency of equipment caused delays in processing blood and blood components and subsequent release of processed blood to consumers. Similarly, 22% (no=2/9) of the respondents in this category said the insufficiency of equipment limited the center's output, while only one (no=1/9; 11%) was of the opinion the insufficiency hindered the frequency of equipment maintenance.

Of the staff sampled, 50% (8/16) believed the center had never had sufficient reagents to maintain continuous operation, while 18.25% (3/16) others believed reagents were always sufficiently provided. However, 31.25% (5/16) did not know whether reagents were sufficient or not at the center. Most staff (43.25%; n=7), did not know whether the ERBTC received reagents regularly or not from the suppliers. However, 37.5% (6/16) stated that the supply of reagents was not regular, while only 18.75% (3/16) believed there was a steady supply of reagents. According to 50% (8/16) of the staff, reagents were usable when they were received, but 37.5% (6/16) of the respondents did not answer this question. About 12.5% (2/16) believed the reagents were not usable when received.

Demand and supply of blood and blood components

The ERBTC supplied only 4730 units of blood during three months period between January 1, 2021 and March 31, 2021, against a demand of 9606 units, resulting in a 50.8% (4876/9606) deficit. Packed red cells (PRCs) were most requested, followed by platelets, fresh frozen plasma (FFP), and whole blood in that order as summarized in Table 2. Table 3 gives a detailed summary of the demand and supply of PRCs and platelets.

Table 2: Blood and blood components requested against supply at the ERBTC

Blood components	Requested units n (%)	Supplied units n (%)	Deficits n (%)
Packed red cells	7803 (81.2)	3309 (42.4)	4494 (57.6)
Platelet concentrates	1566 (16.3)	1197 (76.4)	369 (23.6)
Fresh frozen plasma	218 (2.3)	218 (4.6)	0 (0)
Whole blood unit	19 (0.2)	6 (31.6)	13 (68.4)
Total	9606 (100)	4730 (49.2)	4876 (50.8)

The distribution of blood/blood components requested according to blood groups

Blood group O+ PRCs and platelets were the most requested, while AB– PRCs and AB+ platelets were least requested (Table 4). However, blood group AB– PRCs and platelets were least sufficient as shown variously in Tables 3 and 4 respectively.

Blood wastages and discards

Of the 230 blood donations, 7.8% (18/230) were discarded. Of all the units that were discarded, 66.7%

Table 3: Demand versus supply of PRCs and platelets according to blood groups

	Packed red cells (PRCs)			Platelets		
Blood group	Requested units	Supplied units	Deficit n (%)	Requested units	Supplied units	Deficit n (%)
O+	3219	1287	1932 (60.0)	3219	1287	1932 (60.0)
O−	405	129	276 (68.2)	405	129	276 (68.2)
A+	1797	945	852 (47.4)	1797	945	852 (47.4)
A−	294	60	234 (79.6)	294	60	234 (79.6)
B+	1515	687	828 (54.7)	1515	687	828 (54.7)
B−	252	21	231 (91.7)	252	21	231 (91.7)
AB+	255	174	81 (31.8)	255	174	81 (31.8)
AB−	66	6	60 (90.9)	66	6	60 (90.9)
Total	7803	3309	4494 (57.6)	7803	3309	4494 (57.6)

Table 4: The distribution of blood/blood components requested according to the blood groups

Blood group	Packed red cells	Platelets	FFP	Whole blood	Total	Total (%)
A+	1797	228	36	2	2063	21.5
A−	294	12	12	2	320	3.3
B+	1515	147	12	3	1677	17.5
B−	252	21	1	2	276	2.9
AB+	255	15	3	1	274	2.9
AB−	66	24	2	1	93	1.0
O+	3219	1077	150	6	4452	46.3
O−	405	42	2	2	451	4.7

(12/18) were discarded due to transfusion-transmissible infections, whereas 33.3% (6/18) were due to insufficient volumes. The infections responsible for the discards were categorized as: HIV (16.7%, n=3), hepatitis B virus (44.4%, n=8), and hepatitis C virus (5.5%, n=1).

DISCUSSION

The ERBTC consisted of staff of different cadres; namely, Medical Laboratory Technologists, Nurses, Social Workers, Information Technology Experts, and First Aiders. These staffs were largely Diploma holders. However, the core staffs at the blood bank, Medical Laboratory Technologists, were mainly degree holders. This is consistent with the requirement that higher qualifications are necessary as they enable staff to acquire skills, which are critical in improving the quality and efficiency of testing processes at the ERBTC [11]. However, core staff comprising of Medical Laboratory Technologists stated that they were insufficiently staffed.

The data presented here have showed that challenges that impeded the ERBTC's ability to deliver services to the catchment population included; understaffing, especially of qualified and experienced Medical Laboratory Technologists, insufficiency of financial support to run the Centre's activities, and limited equipment and reagents. McPherson et al. [12] explained that a clinical laboratory can only maintain continuous service delivery if they have backup equipment for quality control and continuity. Our data are consistent with the World Health Organization (WHO) [13] assertion that provision of safe and adequate blood in sub-Saharan Africa (SSA) is hampered by shortages of trained staff, irregular supplies of test kits or use of poor quality test kits, and lack of reliable supply systems and appropriate cold chain facilities. Staff inadequacy as shown in our data reflects the prevailing circumstances elsewhere in Kenya and other countries in the region [14, 15]. According to a Kenyan parliamentary report, Kenya National Blood Transfusion Service (KNBTS) is operating with only 25% of required staffing capacity [15]. Available data have broadly recommended that adequate and qualified staff are required for the provision of efficient, safe, and quality blood transfusion services to the Kenyan public [11, 16].

Similarly, many sub-Saharan African (SSA) countries are constrained by limited financial resources to enable them build capacity, infrastructure, and systems for the provision of blood transfusion services. Available data have shown that the situation can be mitigated by recruitment and retention of regular blood donors, a thorough screening of donated blood for the presence of transfusion-transmissible infections, compatibility testing, and hemovigilance [17]. Countries within the SSA block allocate meager financial resources to this sector and depend mainly on external donor support for

blood transfusion services [18]. Before 2019, the KNBTS had depended 80% on donor support, but this ended in September 2019 [19]. It is possible that the withdrawal of donor funding could have resulted in disruption of National Blood Transfusion Services [9]. Adepoju [20] suggested that governments should put in place measures, including an adequate budgetary allocation to ensure continuity of services upon discontinuation of donor support.

Blood is crucial in patient management and is required universally for surgery, severe anemia, trauma, and pregnancy complications [13]. However, our data have showed that the provision of this vital resource suffers various challenges, including scarcity [21]. The data reported here have revealed a significant mismatch between the demand and supply of blood components at the ERBTC. This mismatch was occasioned by the center not having adequate blood products at the times when requests were made. Kenya, like other developing countries, continues to experience insufficiency in blood supply due to low blood donation rates [2]. For instance, in the year 2018/2019, only 164,000 units of blood were donated to Kenyan Blood Bank Centers, against the WHO recommendation of 1% of a country's population [9, 13]. Our data have showed that PRCs were the most requested component, followed by platelets. However, FFP and whole blood products were rarely demanded at the ERBTC, which concurred with other studies [22, 23] but is inconsistent with results reported in other studies where whole blood was most utilized [24–26].

The ERBTC has adopted a policy recommended by WHO [21] of separating donated blood into specific components to increase the value of each unit to serve patients who need different blood components. However, blood can be transfused as whole blood. According to WHO [21] reporting on data from 2013, 50% of low-income countries were processing whole blood into components. During the same time, 69% of African countries processed whole blood into components and the proportion of whole blood units that were separated into components increased from 54% in the year 2008 to 71% in 2013. Whole blood is often requested in resource-limited settings because of the lack of facilities and cost implications in component preparation [27]. However, our data have showed deficits of PRCs and platelets due to insufficient donations. This is consistent with data reported from elsewhere in Africa and other countries where the supply of blood and blood components is insufficient, and where a stable donor base is difficult to achieve [27–30].

In terms of blood groups, blood group O+ was the most requested, followed by A+, B+, O–, A–, AB+, B–, and AB–, respectively. This finding is consistent with other studies reported by refs. [24–26, 31]. An imbalance between blood supply and demand could therefore lead to the failure of blood transfusion services in any country [32] and preventable mortality and morbidity could worsen the situation [6, 29]. In a study by Thomas et al. [6], children who did not receive blood transfusion as prescribed by physicians, had a mortality of 20%, compared to a mortality of 12% among those who were transfused. Hence, Roberts et al. [29] have recommended strategies like continuous expansion and optimization of national transfusion services, more financial support, and establishment of a regulatory oversight must be instituted to ensure a sustainable supply of adequate and safe blood.

On an average, blood donors at the ERBTC are of 31 years and a majority are males, which is consistent with a report by Tagny et al. [33], who observed that blood donors in SSA are mainly males of secondary school age. Women remain few in the donor pool, mainly due to cultural beliefs that males are healthier than women [33].

Our data have showed a blood discard rate of 7.8%, mainly due to transfusion-transmissible infections (TTIs) and insufficient volumes; the findings which were similarly consistent with those of other studies [24, 32, 34, 35]. One of the challenges facing transfusion safety, especially in sub-Sahara Africa is the high prevalence of TTIs, with a prevalence of 14.1% among prospective blood donors in Kenya [36]. Osaro and Charles [4] and Loua et al. [18] have observed that TTIs accounted for 5.3% of blood discards in the WHO African Region in 2013; 8.7% in Central Africa, 3.1% in East and Southern Africa, and 6.7% in West Africa during the same period. Development and strict adherence to national policies on stringent selection of blood donors, with emphasis on recruitment and retention of voluntary donors, may help in reducing discards due to TTIs [4, 37].

Limitation of the study

This study was limited in several aspects. The data gathered from the staff were dependent on the assumption that their responses and recollections were reliable. Besides, some data were obtained from records for three months, which could contain inherent errors.

CONCLUSION

The Eldoret Blood Transfusion Centre suffers challenges ranging from:

1. Inadequate resources including qualified Medical Laboratory Technologists, funding, equipment, and reagents.
2. Discards of blood and blood products due to transfusion-transmissible infections.
3. Further, the ERBTC experiences mismatch between the demand of blood components and supply.

Recommendations

We recommend employment of more staff, adequate financial allocation from the Kenya government, strict adherence to national policies on blood donor selection

to reduce discards, and more importantly recruiting and striving to retain known voluntary donors.

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Acknowledgments
We wish to thank all staff at the Eldoret Regional Blood Transfusion Center (ERBTC) for their cooperation during data collection

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Guarantor of Submission
The corresponding author is the guarantor of submission.

Source of Support
None.

Conflict of Interest
Authors declare no conflict of interest.

Data Availability
All relevant data are within the paper and its Supporting Information files.