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THE INTERFACE BETWEEN BLOOD PREPARATION AND USE IN UGANDA.

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Running title: Improving the clinical interface.

The authors certify that they have no affiliation with or financial involvement in any organization or entity with a direct financial interest in the subject matter or materials discussed in this manuscript. The authors have full control of the data gathered and presented and agree to allow the journal to review theses if requested.
The study protocols were approved by the Mulago Hospital Research and Ethics Committee and the Uganda National Council for Science and Technology. All patient and staff related data have been anonymised.

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ABSTRACT

Background and objectives The interface between preparation and use blood impacts directly on the outcome of hemotherapy. The present study explores the knowledge and opinions of key players at, practical realities at, and quality improvement strategies of this interface.

Materials and methods We surveyed clinicians (n=81) and blood bank staffs (n=25) to asses their knowledge on key issue in their counterparts' working domains, the turn around time on effecting a blood order from a hospital transfusion laboratory and strategies to improve communication of blood needs to blood banks.

Results Out of the 81 clinicians, 20 knew the four available blood products while only 17 knew the three uses of these products. Twenty three blood bank staffs reported the patient's condition as the main factor on which blood orders are based. Forty four (54.3%) clinicians reported reception of a blood product within an hour of placing the order. Addressing infrastructure and human resource were some of the strategies suggested to improve this step of the transfusion chain.

Conclusions The knowledge of staffs at the extreme ends of the clinical interface in their counterparts' working domain is far from adequate. However, they have well formed opinions on strategies to improve this interface.

Key words: Clinical interface, blood banks.

INTRODUCTION

The blood preparation-utility interface has the blood bank staff with their activities on one end and the clinicians with patients on the other end. Within this interface is the hospital transfusion laboratory. Each of these entities has a specific administrative structure and a well defined set of duties. The successes or failures in the proceedings of a given entity directly impact on the outcomes of the entire interface. The preparing institution (National blood transfusion services) is challenged with building a professionally competent staff to bridge the source of blood (community) to the ultimate users (clinicians with patients). The hospital transfusion laboratory is charged with maintaining the safety and efficacy of the presented blood product before delivering it appropriately to the utility stations in the hospital. It is an obligation for the clinicians at the other end of the interface, to value and treasure the contribution of supportive and preventive hemotherapy in their clinical practices and account for the appropriate use of blood to the donor and community at large [1].

Transfusion of blood elements is an important therapeutic procedure in daily clinical practice which contributes to modern patient management. The preparation of these elements goes through a number of procedures like donor recruitment, their medical examination, donation, processing, transportation and storage of blood products. These take place outside the scope of the hospital therefore escape knowledge and appreciation of clinicians who are the subsequent consumers of the products [2].

Presently only a few clinicians fully realize the on-going scientific advancements in the blood bank world. This causes the quality of patient care to lag behind recent development since a given clinician will not know the currently available blood product for a given patient condition [2, 3]. On the other hand, blood bank staffs minimally appreciate the actual clinical blood needs of the hospitals within their domains. This is due to lack of comprehensive reports describing the clinical epidemiology of blood use [4].

Modern patient care demands excellent, safe products with maximal expertise and involvement from both clinicians and blood bank staffs. This can only be achieved with efficient communication between the institutes. Blood bank representatives have to strive to gain insight into the clinical situations, while clinicians have to be continually informed about the quantity, quality and safety of the available blood products in the bank [2].

Currently the high human development index (HDI) countries are able to optimally use blood by furnishing their hospitals with products like; leukocyte depleted red cells, platelets, neutrophils for granulocyte therapy and plasma products like immunoglobulin cryoprecipitate and fresh frozen plasma. However, the low and medium human development index countries still face logistic and technical challenges in blood component production [5]. Uganda a low-HDI runs a nationally coordinated blood service which is community based and reliant on voluntary non-remunerated blood donors. Currently, the supply of homologous blood in Uganda is inadequate compared to the vast and growing medical and surgical demands. This is evidenced from the statistics of the Uganda blood transfusion services Nakasero where annually 170,000 units of blood are collected from non remunerated donors. This falls short of the WHO requirement of 10,000 units per million population per year by 43.3% which is an

unacceptable situation for a population of 30 million Ugandans. Out of the above collection, the Uganda blood transfusion service (UBTS) is able to supply its hospitals with whole blood, red cell concentrates, platelets and fresh frozen plasma. This institution has been developed with financial and technical support from the ministry of health-Uganda and European or North American countries. It is questionable as to how such blood services will be sustained after external funding sources are no longer available.

In order to optimize the allocated logistics for blood procurement and supply by Uganda's regional blood banks, we explored the clinicians knowledge of availability and use of blood products supplied by Uganda blood transfusion services. Secondary, we studied the opinions of blood bank staff on the factors that they presumed to influence clinician blood ordering practices. Third, we explored the time intervals from making blood orders in the clinical setting to reception of a processed blood product from the hospital transfusion laboratory ready for transfusion. We also analyzed strategies suggested by both clinicians and blood bank staff on how to improve the communication of blood need and supply between the clinical setting and the blood bank.

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MATERIALS AND METHODS

Following approval from the Uganda National Council of Science and technology, a body that oversees all ethical and legal issues pertaining to scientific research in Uganda, we conducted a descriptive cross- sectional survey among clinicians and regional blood bank staff. We used questionnaires to collect information from both groups.

Study setting
The study was conducted in referral (n=3), district and sub-district hospitals (n=3). The referral (RR) hospitals are affiliated to medical training institutions. Thus, Mulago National Referral Hospital to Makerere University College of Health Sciences, Mbarara Regional Referral Hospital to Mbarara University of Science and Technology, Jinja Hospital to Jinja School of Nursing and Midwifery. They are also in close proximity to the regional blood banks and have relatively senior clinicians. On the other hand the district and sub-district hospitals in Kawolo, Kayunga and Mukono have relatively junior clinicians and are further away from their supplying regional blood banks.
In Uganda blood is procured through mobile units and in fixed sites from non-remunerated voluntary donors. The regional blood banks are responsible for activities of donor recruitment, donor selection and blood donations, testing, processing and storage of blood, and distribution of blood and products to hospitals in a given region. The distributed products include whole blood, red cell concentrates, platelets and fresh frozen plasma. These are prescribed for improving oxygen transport, blood volume expansion or treatment of coagulopathies.

The questionnaires and participants
The questionnaire consisted of open-ended questions to ensure freedom and spontaneity of expression of opinions and sections of close-ended questions which were intended to elicit specific responses. To ensure clinical relevance, the questionnaire for clinicians was piloted on six orthopaedic surgeons at Mulago National Referral Hospital and five doctors at Kawolo District Hospital. The questionnaire for the blood bank staff was piloted among six staff members at Mulago Hospital blood transfusion laboratory. They were then delivered by hand to 90 participants in three regional referral hospitals (Mulago in the central region, Jinja in the eastern region, Mbarara in the western region) and three district and sub-district hospitals in the central region (Kawolo district hospital, Kayunga district hospital and Mukono heath centre). The questionnaires for the blood bank staff (n=25) were delivered to all five regional blood banks in Uganda (Nakasero in the central region, Mbarara in the western, Mbale in the eastern, Fort Portal in the western and Gulu in the northern part of the country). The participating clinicians were selected from different specialties on the criteria that they were involved in prescription and administration of blood or blood products in their day-to-day activities. On the other hand all senior staff at the five regional blood banks participated in the study. These included the directors, senior laboratory technicians and senior nursing officers (n=25).

Data analysis
For analytical purposes the responses of clinicians as regards availability and use of blood products were categorized and scored. Knowledge of 0-1 available product was

assigned a score 0 representing unacceptable knowledge, knowledge of 2-3 products was assigned a score of 1 representing an average level of knowledge where as knowledge of 4 products was assigned a score of 2 equivalent to acceptable level of knowledge. If a clinician knew 0-1 use of the available blood products, he was scored 0, if he knew 2 of the three main uses of the supplied products, his level of knowledge was scored 1, where as a clinicians knowledge was scored 2 if he knew all the three main uses of the available blood products.

The time taken from making an order for blood in a clinical setting to reception of a unit of blood from the hospital blood transfusion laboratory was categorized as follows: less than 1 hour, one to six hours, six to twelve hours, twelve to twenty four hours and more than twenty four hours.

Chi square tests were performed to define the differences in the level of knowledge among clinicians and turn around time for receiving a unit blood after it has been ordered for in different hospital settings. All statistical analyses were performed with the help of computer software SPSS version 11.0 and significance defined as p less than 0.05.

Content analysis of suggested strategies to improve communication of blood needs and supply was manually performed.

RESULTS

Of the 90 questionnaires circulated to different hospitals, eighty one (90%) clinicians in different disciplines responded. These included 41 clinicians in district or sub-district (DD) hospitals and 40 from regional referral (RR) hospitals. All twenty five questionnaires circulated to the five regional blood banks were responded to.

Clinicians working in (RR) hospitals had more knowledge of the available blood products compared to those working in (DD) hospitals. (Table 1) Thus, twenty out of forty (50%) clinicians from regional referral hospitals knew all 4 available products. On the contrary, none of the responding clinicians from district or sub-district hospitals knew more than three available blood products. This difference in level of knowledge was statistically significant (p<0.001).
There was a significant difference in level of knowledge of the use of blood products among clinicians working in different settings (p<0.001). Thus, seventeen out the 40 clinicians from the (RR) hospitals knew all three major uses of the supplied products, whereas all respondents from (DD) hospitals knew up to two uses.

The blood bank staff thought that the major contributing factors to the clinical prescription practices were the patient clinical condition - asserted highly influential by 23 out of the 25 respondents and the clinicians knowledge base which was asserted highly influential by 20 staff (Table 2). On the other hand most of the blood bank staff (20/25), felt that hospital transfusion committees had no influence on the ordering practices of clinicians.

It was noted that there is a general delay in reception of blood from the hospital transfusion laboratories in RR hospitals. Only 11 out of the 40 (27.5%) respondents from (RR) hospitals receive a unit of blood in their respective clinical settings within an hour of placing the order (Table 3). On the other hand, thirty three out of the 41(80.5%) clinicians in (DD) hospitals reported that they receive a unit of blood within one hour of placing the order. These difference in time lapse between hospitals of different levels was statistically significant (p<0.001).

In order to improve exchange of information between the clinical settings and blood banks, the respondents' strategies were noted in four domains (Table 4). Infrastructure development entailing items like installation of in-hospital telecommunication systems and computerization of blood ordering and issuing process was suggested by 39 out of 81 clinicians and 15 out 25 blood bank staffs. Up to 41 clinicians and 13 blood bank staffs alluded to the strategy of human resource development. They suggested issues like pre-service induction courses in transfusion medicine with appropriate skill and competence assessment sessions, in-service continued medical education, increase clinical and laboratory staffing like recruiting standby blood bank couriers and timely audits on clinical and laboratory practices with appropriate feed back to the concerned staffs. The establishment of hospital transfusion committees was especially emphasized by blood bank staffs (20/25). They asserted that this would be an opportune avenue to inform hospitals about the quality and quantity of available blood products plus any other

developments in the blood banks. Additionally, these hospital transfusion committees would facilitate flow of information from hospitals to blood banks on issues of blood need and use.

Fifty two (64.2%) clinicians emphasized the need to improve supplies in the laboratories. They felt that improved availability of laboratory utilities like grouping reagents would reduce the blood bank turn around time for processing a given blood order.

DISCUSSION

Optimal patient management with hemotherapy requires a sound communication of clinical blood needs to a well administered blood blank. This study has demonstrated deficiency of knowledge of the available blood products among prescribers in district compared to regional referral Ugandan hospitals. It has also shown that the knowledge of clinicians as regards use of these products is far from adequate. Regional blood banks are not able to supply sufficient blood products to hospitals in their respective jurisdictions. The limited products are stocked in transfusion laboratories of RR hospitals which handle a larger load of patients with greater clinical needs. This gives an opportunity to clinicians working in RR hospitals to fully appreciate the available products. Regional referral hospitals are also affiliated to training institutions. This gives an added advantage to their clinicians to continually review the cardinal uses of blood products hence the observed knowledge gap from their counterparts in DD hospitals. This is comparable to Dhingra and others [6] who found that lack of exposure greatly affected the knowledge and utilization of autologous blood transfusion strategy among physicians working in different specialties and at different levels in a large teaching hospital in India. The blood bank staff collectively asserted that knowledge base of the prescribing clinicians and the patient clinical condition are key determinant of a transfusion order especially in low human development index (L-HDI) countries with minimal laboratory facilities. However, these need to be regulated by guidelines designed and constantly reviewed by hospital transfusion committees in order to ensure patient safety [3].

This study has demonstrated that there is a delay in the reception of a unit blood in the clinical setting after placing the order in a RR hospital compared to a DD hospital. This could be attributed to a higher demand for blood in RR hospitals with a larger patient load which overstretches the limited blood supplies, human and utility resources in their respective transfusion laboratories. It could also be explained by the fact that the clinical settings in DD hospitals are found within the same building as their respective blood transfusion laboratories. This partly ensures faster delivery of blood products to the wards or theaters. On the other hand blood transfusion laboratories in RR hospitals are distant from utility stations. Additionally, blood is delivered by hand to the clinical settings. Therefore, the person delivering a unit of blood from the laboratory is bound to be distracted by whatever causes along the way, hence the observed delays.

Recruitment of a well trained, motivated and sufficient in-hospital staffing as suggested by the participants is an appropriate strategy in facilitating communication between the clinicians and the blood bank. Gonzalezi-Porras and other [7] in their study on errors in pre-transfusion sample collection and labeling (a major communication step between clinicians and blood banks) demonstrated that the quality of this step improves with educational interventions among concerned staffs. They also noted that the error rates were higher in samples collected by bedside nursing staffs compared to those collected by designated blood bank staffs. This fits well with the suggestion by a number of participants in our study of recruiting specific blood bank couriers who assist in the routine to and fro communications and are of paramount importance in acute in-hospital demand of large amounts of blood like in massive trauma.

Installation of in-hospital telecommunication systems as suggested by respondents is a welcome approach in enhancing communication of blood needs and supplies. However, incorporating new technologies in blood supply systems and processes has to answer questions of acceptability, availability and affordability to all hospitals [8].A number of studies [9-11] have shown that introduction of new technologies in transfusion systems impacts directly on an institution's organizational and financial metrics. Therefore, this has to be taken cautiously especially in LHDI countries like Uganda whose hospitals record perennial budget deficits.

Advocacy for installation of hospital transfusion committees is an appropriate strategy in improving communication between clinicians and blood banks.
These determine who is permitted to draw blood samples for pre-transfusion tests, the patient and sample identification protocols, how samples should be transported to the blood bank laboratories, the acceptable laboratory turn around time before a unit of blood is released from reception of the pre-transfusion sample and how blood products should be delivered to utility stations and by whom. Hospital transfusion committees are also responsible for drawing local guidelines on reporting transfusion outcomes to the blood banks and handling of un-used blood products [12, 13].

In summary, the communication of blood needs by clinicians in Ugandan hospitals is far from adequate mainly due to the formers' lack of knowledge of available products and lack of in-hospital communication aids. Secondly, there is no administrative structure in place to regulate the flow of information from clinical settings to the regional blood banks. Thirdly there is an overt delay of delivery of blood products from the blood banks to utility stations especially in regional referral hospitals. Finally, the participants in this study outline appropriate strategies to improve the flow of information between clinicians and blood banks.
We recommend a nationwide survey to establish the epidemiology of blood use in Ugandan hospitals. This in turn will guide the allocation of logistics on procurement, processing and distribution of blood products in Uganda. We think these strategies and recommendations can easily be achieved if they are prioritized in the hospitals and National fiscal budgets.

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Table 1. Clinicians' knowledge of availability and use of blood products.

	Clinicians in district or sub-district hospitals (n=41)	clinicians in regional referral hospitals (n=40)	
Knowledge of available product			
0 to 1 product	7	4	
2 to 3 products	34	16	**(p<0.001)**
all 4 products	0	20	
Knowledge of use of product			
0 or 1 use	26	6	
2 uses	15	17	**(p<0.001)**
3 uses	0	17	

Table 2. Factors influencing clinical ordering practices as perceived by the blood bank staff.

| | Responding blood bank staff (n=25) | | |
	Highly Influential	minimally Influential	No Influence
Patient clinical condition	23	1	1
Clinicians' knowledge base	20	5	0
Availability of blood	12	9	4
Availability of guidelines	10	7	8
Influence from hospital transfusion Committee	2	3	20

Table 3. Time taken from making a blood order by the clinician to reception of a unit of blood in the clinical setting from the blood bank.

	District or sub-district Hospital	Regional Referral Hospital	
I don't know	1	0	
More than 24 hours	0	7	
12 to 24 hours	0	8	**(p<0.001)**
6 to 12 hours	0	3	
1 to 6 hours	7	11	
Less than 1 hour	33	11	

Table 4. Strategies to improve communication between clinical setting and blood banks.

	suggestions by clinicians (n=81)	suggestions by blood bank staff (n=25)
Infrastructure development	39 (48.1%)	15 (60%)
Human resource development	41 (50.6%)	13 (52%)
Establishing hospital transfusion committees	9 (11.1%)	20 (80%)
Availing recurrent utilities	52 (64.2%)	5 (20%)

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