Adherence to clinical guidelines for use of blood components at a tertiary hospital in Ghana

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Study conducted at Volta Regional Hospital, Ho, Volta Region, Ghana

Running head: Use of blood components in Ghana

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# Abstract

## Background and objectives

Guidelines for blood transfusions can help to ensure that blood is used appropriately, to avoid wastage and minimise risks, and are particularly important in sub Saharan Africa because chronic blood shortages are widespread. This study explored transfusion practices and guideline compliance among clinicians at a tertiary hospital in the Volta region of Ghana.

## Materials and methods

Participants in this three-month study were clinicians from several hospital departments. The mixed methods study used a questionnaire to assess clinicians’ knowledge of transfusion. Retrospective data from hospital records were used to assess whether each transfusion given during the study period complied with recommendations in the national transfusion guidelines.

## Results

Although 44/50 clinicians self-rated their knowledge of transfusion in the questionnaire as good, only two were aware of the national transfusion guidelines, 48% listed incorrect indications for FFP and there was considerable variation in haemoglobin thresholds they used to guide transfusion decisions. Of the 313 transfusions of whole blood/packed cells and fresh frozen plasma (FFP) given during the study, 49% were not in accordance with the guidelines. For the 31 FFP transfusions, under-dosing was common (87%) and 52% were not in accordance with the guidelines. 46/220 (21%) patients had no cause for anaemia documented during their admission.

## Conclusion

There is a need to improve awareness of, and compliance with, national guidelines. A multi-faceted approach including education, guideline dissemination, transfusion audits and oversight from a hospital transfusion committee could contribute to much more effective use of blood components.

Keywords: sub-Saharan Africa, Ghana, national guidelines, clinical use, appropriate use, education

# Introduction

Blood transfusion in sub-Saharan Africa remains a vital treatment, especially in preventing mortality from obstetric haemorrhage, and severe anaemia in children due to malaria. Reductions in mortality in pregnant women and children under the age of five are key targets of the Sustainable Development Goals. Access to safe blood plays a key role in optimising maternal and child health, as well as health across populations. This requires the rational use of blood, as recognised by the WHO Global Consultation on Universal Access to Safe Blood Transfusion. [1]

Within sub-Saharan Africa, blood shortages are widespread. One reason is a lack of donors, reasons for which include misconceptions regarding risks to donors, and cultural and religious beliefs surrounding blood. [2] Compounding this are high rates of anaemia and infection markers in potential donors, and so many are deferred or rejected. [3] Therefore, appropriate blood use, supported by national guidelines, is critical. Published data on compliance with national transfusion guidelines in sub-Saharan Africa are limited.

Ghana is one of 34 out of 46 countries in the WHO African region that has national guidelines on the appropriate clinical use of blood. [4] The National Blood Service of Ghana (NBSG), operating under the Ministry of Health, is responsible for the collection, processing, storage and distribution of blood, as well as monitoring its use. [5] Supplies of blood in Ghana remain inadequate as, despite the efforts of NBSG, recruitment of blood donors has not reached the WHO-recommended level of 10 donations per 1000 people. [6] In part, this is due to high background prevalence of infections that can be transmitted by transfusion. Hepatitis B virus prevalence in Ghana is estimated to be 12% [7] and the prevalence of HIV in antenatal women is 2.4%. [8] NBSG has produced the national Clinical Guidelines for the Use of Blood and Blood Products to support appropriate use of blood, issued in 2002 and revised in 2009 by a working group comprising Ghanaian transfusion specialists, consultants in haematology, obstetrics and gynaecology, paediatrics, and anaesthetics. [9] NBSG plans to revise the guidelines in 2018.

This study aimed to assess the compliance of clinicians with the national guidelines at a regional hospital in Ghana and to understand this in relation to their knowledge and perception of transfusion issues. The overall purpose of the study was to develop a process for assessing compliance with transfusion guidelines that may be applicable beyond Ghana, and to provide evidence for NBSG to guide their next steps in revising and improving compliance nationally with the guidelines.

# Materials and methods

The study took place at the Volta Regional Hospital (VRH), a tertiary hospital in Ghana. The Volta region is one of ten administrative regions in Ghana, with an estimated population of 2.4 million. [10] VRH is the sole referral hospital for the region, and is presently transitioning to teaching hospital status, in association with the University of Health and Allied Sciences. Patients are expected to meet some of the costs of transfusion - family members who donate blood to replace that used by their relatives pay US$7 per unit for processing; those whose relatives cannot replace blood pay US$30 per unit.

The study comprised three phases: semi-structured interviews with clinicians to understand issues concerning transfusion decisions and the use of guidelines; a questionnaire for clinicians based on the NBSG guidelines and supplemented with information from interviews; and a review of hospital records to assess the appropriateness of transfusion requests compared to the NBSG guideline recommendations.

### Semi-structured interviews

Interviews were conducted with 11 clinicians, identified opportunistically to include clinical staff from all departments that regularly use blood. These included medicine, surgery, obstetrics and gynaecology, paediatrics and anaesthetics; anaesthetic clinicians were specialised nurses. Interviews were based on themes within the national guidelines and covered perceived indications for transfusion of blood components, difficulties encountered in obtaining blood, and whether transfusion decisions were informed by NBSG guidelines. A semi-structured format was chosen for the interviews, with initial broad questions and more detailed probes, to allow further exploration of topics of interest. Information from the interviews was not formally analysed as its purpose was to inform the content of the questionnaires.

### Clinician questionnaires

A structured questionnaire was developed, based on the NBSG guidelines as well as topics that emerged from the interviews, which addressed three themes (see Appendix 1 for full questionnaire). The first theme was knowledge of specific aspects of transfusion covered in the guidelines, including indications for transfusion, complications of transfusion, haemoglobin thresholds for guiding transfusion, and other clinical features that may guide transfusion. The second theme, informed by the interviews, covered potential difficulties encountered around transfusion, such as the impact of shortage of supplies, and potential limitations in testing. The final theme was education, to understand how clinicians obtained knowledge about transfusion, and to determine what proportion of clinicians were familiar with the contents of the national guidelines. Many of the questions enabled respondents to choose a response on a Likert-type scale. For example, self-rated confidence in prescribing transfusions had choices from 1-5, where 1 was least confidence and 5 was highest confidence. Responses to other questions allowed free-text, such as listing clinical features that would affect a decision to transfuse. Median responses were used in the analysis to indicate the view of the majority of respondents.

The questionnaire was piloted amongst 10 clinicians from all departments over a 2-week period. Following minor changes to improve the clarity of specific questions, the final version was given to all clinicians present at weekly departmental meetings for medicine, surgery, obstetrics and gynaecology, and paediatrics (50 clinicians in total) over a 3-week period.

### Review of hospital records

Transfusion episodes occurring in all patients at VRH receiving blood components between 1st Sept and 30th Nov 2017 were identified retrospectively using blood bank records. Patients’ medical notes were accessed from wards or the records department. Corresponding blood test results were obtained from the electronic Hospital Administration and Management System and from stored data from full blood count analysers.

The NBSG guidelines were used to design a proforma which was used to record information from patient and hospital records (Appendix 2). A separate proforma was completed for each transfusion episode and the proforma was anonymised, and included a unit number to avoid duplication. Demographics including patient’s age and sex, and the department requesting the transfusion were recorded. The date and result of haemoglobin tests before and after transfusion were recorded to determine whether transfusion decisions and followup had been guided by recent haemoglobin results as recommended in the NBSG guidelines.

Each patient’s folder was reviewed to determine if the cause of anaemia had been investigated, if not known initially. NBSG guidelines state that the underlying cause of anaemia should be investigated. Cases where the cause of anaemia was known (and thus did not need investigation) were defined as bleeding with a known source (including peri-operative blood loss, ruptured ectopic pregnancy, peri-partum haemorrhage, menorrhagia with known fibroids, and trauma), diseases known to cause anaemia (chronic kidney disease, malaria, sickle cell disease, known haematological malignancy) and paediatric sepsis. This latter criterion was used following a study of paediatric anaemia in Malawi which found that bacteraemia was strongly associated with anaemia. [11]

The NBSG guidelines provide indications for transfusion in specialty-specific groups, namely paediatrics, obstetrics, surgery and medicine. The proforma therefore included specific sections for each of these groups.

We wished to establish whether blood was being used appropriately for indications that were clearly defined in the national guidelines. Therefore, a checklist for appropriate transfusion was developed using the indications for transfusions listed in the guidelines. The checklist was reviewed by the Head of Research and Development at NBSG, with input from colleagues who had been involved in writing the guidelines, and was revised following their feedback to ensure it accurately reflected the guidelines.

Using the checklist, each transfusion episode was classified as appropriate or not appropriate. For example, in a surgical patient with intra-operative estimated blood loss of over 30% of blood volume, transfusion would be classified as appropriate; in a paediatric patient with a haemoglobin over 6.0g/dL with no active bleeding, transfusion would be classified as inappropriate. In cases where data from the notes were insufficient, or the specific clinical situation was not addressed by the guidelines, appropriateness was classified as unknown.

# Results

## Clinicians’ transfusion knowledge and self-reported transfusion practice

Of 50 questionnaires issued, 44 responses (88%) were received. The number of respondents from each specialty were 9 medical, 15 paediatric, 10 obstetrics and gynaecology, and 10 surgical. 66% of respondents were house officers, reflecting the staffing balance at VRH. 98% of respondents had derived their transfusion knowledge from undergraduate teaching; only 5% were aware of the national guidelines (Fig. 1). Respondents felt knowledgeable of the indications and complications of transfusion, and confident about transfusion practice (Fig. 2).

Respondents perceptions of the accuracy and turnaround time of full blood count results indicated that the majority perceived the results as “mostly accurate”, and the timeliness as “satisfactory” (Fig. 3a,b). Results showed considerable variation in haemoglobin thresholds used to guide transfusion decisions. These ranged from 4 to 8g/dL for asymptomatic anaemia, 4 to 10g/dL for symptomatic anaemia and 5 to 9g/dL for chronic kidney disease (CKD). The NBSG guidelines state that adult medical patients with chronic anaemia should be transfused if haemoglobin is below 4-5g/dL [9]. Stated indications for FFP (Table 1) included coagulopathy (64%), in agreement with NBSG guidelines, however 48% of respondents listed indications that were not mentioned in the guidelines.

Clinical features influencing transfusion decisions are shown in Table 2. The most common clinical features mentioned were heart rate (48%), symptoms(30%) (including dizziness, palpitations, shortness of breath, ‘easy fatigability’) and pallor (27%). The NBSG guidelines state that clinical features influencing transfusion decisions include cerebral hypoxia and incipient cardiac failure, although these terms are not further defined. Pallor is not mentioned within the guidelines.

Risks of transfusion that respondents would consider when making transfusion decisions were “reactions” (77%: type often not specified), transfusion-associated circulatory overload (43%), transfusion-transmitted infection (27%) and transfusion-related acute lung injury (14%).

35 of 44 respondents (80%) indicated that they had experienced difficulty in obtaining required blood components from the blood bank over the preceding three months. 25% of respondents had cared for patients in the preceding three months who had experienced adverse events due to these difficulties. These consisted of delayed surgery (3 respondents; 15 patients affected), delayed discharge (8 respondents; 24 patients affected) and death (3 respondents; 4 patients affected).

## Documented transfusion practice and estimate of appropriateness of transfusions

395 transfusions were identified from the blood bank records and patient notes were retrieved for 313 transfusions (79%) in which 232 patients received a total of 474 units. Of all units used, 82% were whole blood, 12% were FFP, and 6% were packed cells. Obstetrics and gynaecology used the most blood components (38%) and paediatrics the least (13%). 26% were used by medicine, and 22% by surgery.

### Peri-transfusion haemoglobin results

Pre- and post-transfusion haemoglobin results were reviewed for the 282 episodes involving transfusion of whole blood or packed cells. Two of these were exchange transfusions for neonatal jaundice and were therefore excluded from the analysis; one patient had no result for a haemoglobin test that had been requested and two patients had pre-transfusion haemoglobin tests but test dates were unknown. Of the remaining 277 episodes, 252 episodes (91%) had a haemoglobin result checked within four days prior to the date of transfusion.

The mean pre-transfusion haemoglobin was 7.3g/dL, however, this value alone cannot be used as a surrogate for appropriateness of transfusion, as it does not reflect other factors that may influence transfusion, including acute blood loss.

In 20 episodes of whole blood and packed cell transfusion, the patient died following transfusion, and in one episode the date of post-transfusion haemoglobin was unknown. Of the remaining 259 episodes, 181 had a haemoglobin checked within 4 days after the transfusion (70%).

### Investigation of causes of anaemia

Of the 220 patients transfused whole blood or packed cells (excluding exchange transfusion), 62 patients (28%) had no known cause for anaemia documented in the notes at the time of transfusion and in 46 (21%) no cause was subsequently identified throughout their admission. 93 of these 220 patients (42%) had a microcytic anaemia (MCV < 80.)

## Appropriateness of transfusion decisions

According to NBSG recommendations (see Appendix 3 for checklist), of all 313 transfusions, 148 (47%) were appropriate, 153 (49%) were not appropriate and 12 (4%) were unknown (Table 3.)

144 of 282 (51%) whole blood or red cell transfusions were appropriate. For FFP only 4 of 31 (13%) transfusions were appropriate. Of these 31 transfusions, 21 (68%) used an inadequate volume of FFP, and 16 (52%) were given for indications not stated in the guidelines.

The blood bank estimated that the cost of consumables such as blood bags and infection screening tests over the 3-month period for the inappropriate transfusions, borne by VRH, amounted to US$2000.

### Department-specific use of blood components

The appropriateness of use of blood components varied by department (Table 3; Fig. 4a,b). In medicine, 11 (31%) inappropriate whole blood/ packed cell transfusions occurred in patients with chronic kidney disease. In surgery, 11 (38%) inappropriate whole blood/ packed cell transfusions were for trauma patients who did not have signs or symptoms to suggest major haemorrhage. All 3 FFP transfusions in surgery were given for hypoalbuminaemia, and thus not appropriate. In paediatrics, 9 (36%) inappropriate whole blood/ packed cell transfusions were for children with sepsis. 4 of the 5 inappropriate paediatric FFP transfusions were for nephrotic syndrome. 7 (44%) of the inappropriate transfusions in gynaecology patients were for patients with fibroids.

# Discussion

### Appropriateness of transfusions

Half of all whole blood and packed cell transfusions may not have been needed since they were not given in accordance with the guidelines. These data need to be interpreted cautiously since it is difficult to gauge the appropriateness of clinical decisions from patients notes due to limited detail, however these results are similar to those from a study in Malawi that used an independent clinician-observer to judge the appropriateness of transfusion decisions against guidelines in real-time, where 44% of transfusion decisions were not in accordance with guidelines [12]. Inappropriate transfusions may arise from problems with speed or accuracy of laboratory haemoglobin results [13], but in our study, the accuracy and turnaround time of haemoglobin tests was perceived as satisfactory. Despite the majority of clinicians stating that they were reasonably knowledgeable and confident in their transfusion practice, there were wide variations in the haemoglobin triggers they used to guide transfusion practice which were at variance with those in the national guidelines. Unnecessary transfusion may result from limited education on transfusion, supported by the finding that only 5% of clinicians were aware of the national transfusion guidelines.

During feedback meetings with clinicians to discuss the results, several clinicians mentioned that they used a clinical diagnosis of anaemia to guide decisions, and that they believed this method to be more reliable than laboratory haemoglobin results [author AD, personal observation], a phenomenon previously reported in Malawi [14]. Studies of pallor in sub-Saharan Africa indicate that whilst it is sensitive for severe anaemia (haemoglobin below 5.0g/dL), it is not specific enough to be used for diagnosis of anaemia [15, 16] or to guide transfusion decisions. Similarly, signs and symptoms that may reflect anaemia such as tachycardia and shortness of breath can have other causes, therefore their diagnostic utility is limited. This behaviour may reflect previous unavailability of accurate diagnostic tests. It may be helpful for transfusion education to challenge this practice where adequate laboratory testing exists.

### FFP demand and use

Overall less than half of FFP transfusions were given for indications recommended in the guidelines, reflected in clinicians’ knowledge about FFP use. Only 13% of FFP was given at an appropriate dose. VRH produces FFP by manual separation of plasma from whole blood which results in large variations in the volumes. On a randomly selected day, the volumes of all 11 stored FFP units in the lab were measured and they ranged from 10-150mL/unit (median 60mL) [author AD, personal communication] which made it difficult for clinicians to obtain an adequate therapeutic dose for adult patients. FFP demand was low as a percentage of all transfusions (12%). It may be helpful to conduct a formal assessment of the clinical need for FFP and associated tests, such as clotting screens (not available at VRH), to determine if FFP production is a priority for investment in the short term given the limited resources available.

### Investigation of causes of anaemia

One fifth of patients had no cause for anaemia documented in their notes either before transfusion or during their admission. Over 40% of transfused patients had microcytic anaemia which in Ghana would most commonly be due to iron deficiency anaemia or a haemoglobinopathy [17, 18]. Only a limited number of investigations to determine the cause of anaemia are available at VRH and patients may not be able to afford investigations. If the underlying cause of anaemia is not investigated or treated, anaemia may recur, resulting in further transfusions, exposing patients to potential side effects as well as depleting blood supplies. In the absence of tests to investigate anaemia, empirical iron therapy may be considered for patients with microcytic anaemia. Although there are concerns about iron supplementation possibly increasing infection risk [19], a Cochrane review concluded that where services for prevention and management of malaria are available, iron does not increase the risk of malaria [20].

### Strengths and limitations

This study used a mixed methods approach to collect complementary data from interviews, questionnaires and document review. This permits a more synergistic way of addressing a complex research question than is possible with separate quantitative and qualitative data [21].

Some data were incomplete since, despite an extensive search, notes pertaining to 82 of the total 395 transfusion episodes (21%) could not be located.

The study covered a 3-month period in the dry season between September and November, so paediatric transfusions, which peak in the rainy season due to an increase in malaria transmission, are under-represented - these comprised 23% of all units transfused in June (peak rainy season), compared with 13% of units in the study period. Snake-bite is also more prevalent in the rainy season, and so cases of envenomation, often treated with blood components, are likely under-represented.

### Next steps

Translating guidelines into clinical practice is notoriously difficult due to several factors such as lack of awareness of the guidelines [22], disagreements with recommendations, and guideline complexity. [22, 23] Several of these factors were evident in this study and addressing them requires a multi-faceted approach including, but not limited to, clinician education. There is some evidence that interventions such as guidelines, audits and reminders, may successfully reduce clinicians’ utilisation of blood products. [24] NBSG needs to ensure that, once its new guidelines have been developed, they are widely disseminated and easily accessible. Almost none of the clinicians had received transfusion education since their undergraduate courses so dissemination of the new guidelines will need to be accompanied by a nationwide educational programme to ensure that the guidelines have good visibility and are well understood.

Findings from this study were presented to clinicians from the participating departments, blood bank staff and senior hospital managers. Discussions focused on the need to check pre- and post-transfusion haemoglobin, to improve awareness of the national transfusion guidelines and indications for transfusion, and the importance of using laboratory results as well as clinical assessment to guide transfusion. To support this, posters listing the indications for transfusion were designed and displayed in clinical areas.

Hospital-level oversight of transfusion is not currently embedded within systems in Ghana. WHO and NBSG advocate the establishment of hospital transfusion committees (HTC) to oversee the appropriate use of blood [1, 5]. At present the only HTC in Ghana is based in Kumasi. It was established 15 years ago and has helped increase the local blood supply, which now exceeds the WHO target of 10 donations per 1000 population. It has also managed research to identify the most accurate rapid tests available for HIV and hepatitis B and C screening, and has determined clinical policies for blood use based on input from local stakeholders. [25] Similar benefits could be realised from an HTC at VRH, providing there is commitment from the relevant stakeholders, and support from hospital management in providing the necessary resources for the HTC to function. The committee’s role would include monitoring the clinical use of blood components at VRH and taking appropriate action where needed.

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Authorship:

AF developed the initial concept, and AD developed the audit protocol. AD and EA gathered the data. AD wrote the manuscript, with revision from AF, EA, and IB. IB supervised and assisted with the study design and execution at all stages.

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# Figure and table legends

Figure 1. Sources of respondents’ transfusion knowledge

Figure 2. Self-rated knowledge and confidence in making transfusion decisions (from 1-5, where 5 is highest value)

Figure 3a. Respondent perception of accuracy of full blood count results at VRH

Figure 3b. Respondent perception of speed of full blood count results at VRH for routine requests

Figure 4a. Number of whole blood and packed red cell transfusions, by department and appropriateness

Figure 4b. Number of FFP transfusions, by department, sufficiency of volume used, and presence/ absence of guideline indication

Table 1 Stated indications for use of FFP

*Table 2 Stated clinical features guiding transfusion decisions*

*Table 3 Appropriateness of transfusions, by specialty*

# Figures and tables

Figure 1



Figure 2

Figure 3a

Figure 3b

Figure 4a

Figure 4b

|  |  |  |
| --- | --- | --- |
| Stated indication for FFP | Number (percentage) of respondents, total = 44 | Listed in NBSG guidelines? |
| Coagulopathy/ disseminated intravascular coagulation | 28 (64) | Yes |
| Hypoalbuminaemia | 11 (25) | No |
| Thrombocytopenia | 10 (23) | No |
| Nephrotic syndrome | 5 (11) | No |
| Snake bite | 5 (11) | No |
| Liver failure | 4 (9) | No |
| Paracentesis | 2 (5) | No |
| Massive transfusion | 1 (2) | Yes |
| Warfarin reversal | 1 (2) | Yes |

Table 1

|  |  |  |
| --- | --- | --- |
| Clinical features guiding transfusion decisions | Number (percentage) of respondents, total = 44 | Referred to in NBSG guidelines? |
| Heart rate | 21 (48) | No |
| Symptoms of anaemia | 13 (30) | Yes1 |
| Pallor | 12 (27) | No |
| Respiratory rate | 11 (25) | Yes1  |
| Underlying condition | 11 (25) | Yes2 |
| Blood pressure | 9 (21) | Yes3  |
| Comorbidities | 8 (18) | Yes2 |
| Signs of hypovolaemia | 5 (11) | Yes3 |
|  |  |  |
| 1. Refers to “cerebral anoxia or incipient cardiac failure”
 |
| 1. Specific recommendations are made for those with acute blood loss, haematological malignancies, sickle cell disease, acute haemolysis, on cytotoxic treatment, or “elderly”
 |
| 1. Only relevant if acute blood loss
 |

*Table 2*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Type of transfusion | Total | Number appropriate (% of total) | Number inappropriate (% of total) | Number unknown (% of total) |
| All departments |  |  |  |  |
| Whole blood/ red cells | 282 | 144 (51) | 126 (45) | 12 (4) |
| FFP | 31 | 4 (13) | 27 (87) | 0 (0) |
| Total | 313 | 148 (47) | 153 (49) | 12 (4) |
| Medicine |  |  |  |  |
| Whole blood/red cells | 67 | 31 (46) | 36 (54) | 0 (0) |
| FFP | 7 | 0 (0) | 7 (100) | 0 (0) |
| Total | 74 | 31 (42) | 43 (58) | 0 (0) |
| Surgery |  |  |  |  |
| Whole blood/red cells | 59 | 25 (42) | 29 (49) | 5 (9) |
| FFP | 3 | 0 (0) | 3 (100) | 0 (0) |
| Total | 62 | 25 (40) | 32 (52) | 5 (8) |
| Paediatrics |  |  |  |  |
| Whole blood/red cells | 52 | 25 (48) | 25 (48) | 2 (4) |
| FFP | 9 | 4 (44) | 5 (56) | 0 (0) |
| Total | 61 | 29 (48%) | 30 (49) | 2 (3) |
| Obstetrics |  |  |  |  |
| Whole blood/red cells | 74 | 50 (68) | 20 (27) | 4 (5) |
| FFP | 12 | 0 (0) | 12 (100) | 0 (0) |
| Total | 86 | 50 (58) | 32 (37) | 4 (5) |
| Gynaecology |  |  |  |  |
| Whole blood/red cells | 30 | 13 (43) | 16 (53) | 1 (3) |
| FFP | 0 | 0 (0) | 0 (0) | 0 (0) |
| Total | 30 | 13 (43) | 16 (53) | 1 (3) |

Table 3