Research Article

# Challenges of Blood Transfusion Services in Abia State: A Study on Infrastructure and Manpower

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### Abstract

**Background:** Blood transfusion services are vital to healthcare delivery, yet many health institutions face challenges related to infrastructure and manpower. This study aims to assess the availability and adequacy of blood transfusion equipment and staff in healthcare institutions across Abia State, Nigeria.

**Materials and Methods:** A cross-sectional, retrospective study was conducted over six months in 13 public and private health institutions across the three senatorial zones of Abia State: Abia North, Abia South, and Abia Central. Data were collected using a semi-structured, pretested interviewer-administered questionnaire, supplemented by blood bank records, covering the period from January to June 2022. The study assessed the availability of dedicated blood transfusion staff, the existence of blood transfusion committees, quality policies, and the types of blood screening methods used. Statistical analysis was performed using SPSS version 23, with results expressed in frequencies, percentages, and means.

**Results:** The majority of institutions were secondary (77%) and had poor availability of blood transfusion equipment (92.3%), with only 38.5% having a dedicated blood bank and 84.6% possessing benchtop centrifuges. Critical equipment such as apheresis machines, cold centrifuges, -20°C freezers, and platelet agitators were entirely absent. In terms of manpower, 92.3% of blood banks had dedicated staff, but none reported adequate staffing. Only 7.7% had a consultant haematologist, and 23.1% employed trained phlebotomists. Screening methods for HIV, hepatitis B, hepatitis C, and VDRL relied entirely on rapid tests, with no ELISA use reported.

**Conclusion:** The study highlights significant challenges in blood transfusion services in Abia State, with inadequate infrastructure and insufficient manpower being key issues. Urgent interventions are needed to improve equipment availability and staffing to ensure safe and effective blood transfusion services.

**Kew Words:** blood transfusion, infrastructure, manpower, healthcare institutions, equipment availability, screening methods

## Introduction

Blood transfusion services are a critical component of modern healthcare, playing a vital role in saving lives and improving health outcomes. These services ensure that safe and sufficient blood supplies are available to meet the needs of patients requiring transfusions due to surgical procedures, trauma, hematologic conditions, and other medical situations. However, the effectiveness of blood transfusion services is heavily dependent on the adequacy of infrastructure, the competence of staff, and the reliability of screening methods used to ensure blood safety. In many developing countries, including Nigeria, challenges in these areas can significantly impact the quality and availability of blood transfusion services [1, 2].

Infrastructure is a foundational element in the provision of blood transfusion services. It encompasses the physical facilities, equipment, and technology necessary to store, process, and distribute blood safely. In Nigeria, particularly in Abia State, the infrastructure of blood transfusion units often faces significant challenges, including inadequate storage facilities, outdated or malfunctioning equipment, and insufficient blood bank capacities [3]. These deficiencies not only hinder the ability to maintain an adequate blood supply but also compromise the safety and quality of blood products, increasing the risk of transfusion-transmitted infections (TTIs) [4].

The World Health Organization (WHO) emphasizes the importance of robust infrastructure in ensuring the safety and adequacy of blood supplies [5]. However, studies have shown that many blood transfusion services in Sub-Saharan Africa operate under suboptimal conditions, with limited access to modern blood banking technologies and facilities [6]. In Abia State, these infrastructural challenges are compounded by issues such as unreliable electricity supply, which can disrupt the storage of blood products, leading to spoilage and wastage [7].

The quality of blood transfusion services is also heavily reliant on the competence and availability of staff. Trained personnel, including blood bank technicians, laboratory scientists, and medical officers, are essential for the safe collection, processing, testing, and transfusion of blood [8]. However, in many health institutions across Nigeria, there is a significant shortage of adequately trained staff, leading to overwork, burnout, and potential errors in the transfusion process [9].

In Abia State, the staffing challenges in blood transfusion services are exacerbated by a lack of continuous professional development opportunities and inadequate training programs [10]. This situation results in a workforce that may not be fully equipped to handle the complexities of modern blood transfusion practices, particularly in the areas of blood screening and patient safety. Moreover, the absence of standardized protocols and the inconsistent application of existing guidelines further complicate the provision of safe and effective transfusion services [11].

Ensuring the safety of blood supplies through effective screening methods is crucial to preventing TTIs such as HIV, hepatitis B and C, and syphilis. In Nigeria, the prevalence of these infections among blood donors remains a significant concern, necessitating rigorous screening protocols [12]. However, the effectiveness of screening methods used in blood transfusion services in Abia State is often compromised by several factors, including the use of outdated testing technologies, lack of reagents, and insufficient quality control measures [13].

Recent studies have highlighted the need for the adoption of more advanced screening techniques, such as nucleic acid testing (NAT), which offers higher sensitivity and earlier detection of infections compared to traditional serological methods. Despite this, many blood transfusion services in Abia State continue to rely on less sensitive methods due to cost constraints and lack of technical expertise [14]. This situation poses a significant risk to blood safety and underscores the need for urgent improvements in screening practices.

## Materials And Methods

### Study Design

A cross-sectional six-month retrospective study was conducted in both Abia state public and private health institutions. Health facilities that met the inclusion and exclusion criteria were recruited in the study. The three Senatorial zones in Abia state were involved: Abia North, Abia South and Abia Central. Four to five health institutions that met the inclusion and exclusion criteria were recruited from each of the three senatorial zones respectively.

### Study Area

Abia State is a state in the Southeast geopolitical zone of Nigeria, it is bordered to the north and northeast by the states of Enugu and Ebonyi, Imo State to the west, Cross River State to the east, Akwa Ibom State to the southeast and Rivers State to the south. Abia State occupies about 6,320 square kilometres of land with an estimated population of over 3,720,000 as of 2016 [15]. It has three Senatorial zones: Abia North, Abia South and Abia Central. Each senatorial zone consists of 6, 6, and 5 LGAs respectively. On the whole, Abia state has a total of 17 Local government areas (LGA). Abia state has about 200 registered hospitals and clinics.

### Data Collection

A semi-structured, pretested, interviewer-administered questionnaire (adapted from the National Blood Transfusion, Ministry of Health) was used for the study. Blood bank records were used where necessary. Information was obtained from data covering January to June 2022. Data were collected between November 2023 and February 2024 in Health facilities in Abia State and a total of 13 health facilities were used. The data collected include:

i. **Demographic Data**: The following information was collected under demographic data: Senatorial zone. Type of the Institutions (Secondary and tertiary), Specialty (multispecialty), Number of dedicated staff in the blood transfusion unit and presence of active blood transfusion committee.

ii. **Staff availability and adequacy:** The following questions were asked: Are there dedicated qualified staff in the blood bank?, Are adequate staff stationed in the blood bank?, are there presence of consultant Haematologists and medical laboratory scientists (Haematology)? , Is the number of medical laboratory scientists (Haematology) adequate? Is the number of medical laboratory scientists (others) adequate? Are their support staff /others? Is the number of support staff adequate? Are there phlebotomists, blood donors counselling and Recruiters? The above questions were used to assess the availability into Poor availability = ≤49.9%, Fair availability =50.0-69.9%, adequate =≥70%.

iii. The following questions were asked under the assessment of training of blood bank staff: Is there a scheduled training program in place, is the staff training in the blood bank regular or irregular?

### Ethical Consideration

This study was approved by the Health Research Ethics Committee (HREC) of the Federal Medical Centre, Umuahia, Abia State with the ethical approval number FMC/QEH/.596./Vol.10/690.

## Statistical Analysis

Data was analyzed using the SPSS version 23 statistical package. Continuous variables were analyzed using descriptive (means, standard

deviation, median) while categorical variables were analyzed in frequency and proportions. A p-value of 0.05 or less was considered statistically significant.

## Results

The study was conducted across three senatorial zones in Abia State: Abia North and Abia South each representing 30.8% of the respondents, while Abia Central had the highest representation at 38.5%. Most of the respondents were from secondary institutions (77%), with only 23% from tertiary institutions. A notable finding was the absence of dedicated staff in several blood transfusion units, as only 12.5% had two or more staff members, while the majority (53.8%) operated with just one staff member. None of the institutions had an active blood transfusion committee or a quality officer dedicated to blood issues (Table 1).

While microscopes and benchtop centrifuges were available in all or most institutions, more critical equipment like ELISA machines, dedicated generators, and domestic freezers were scarce. The complete absence of

apheresis machines, -20°C and -80°C freezers, platelet agitators, and first aid kits points to significant infrastructural gaps in blood transfusion services (Tables 2a and 2b). The vast majority (92.3%) of health institutions had poor availability of blood transfusion equipment, with only one institution reaching a fair availability score (50–69.9%). None of the institutions had adequate equipment (≥70%) (Table 3).

In terms of staffing, 92.3% of the institutions had dedicated staff in the blood bank units, but none had adequate staff levels. Only one institution had a consultant haematologist, while 53.8% had a haematologist medical laboratory scientist, and 76.9% had support staff. However, the number of qualified staff was insufficient across the board (Tables 4 and 5).

Screening for infectious diseases such as HIV, hepatitis B, hepatitis C, and syphilis was performed using rapid tests in all institutions (100%). There was no use of the more sensitive ELISA method for any of the tests. The availability of standard operating procedures (SOPs) for screening varied, with 61.5% of institutions having them in place (Table 6).

| Characteristic | Frequency | Percentage |
|---|---|---|
| Senatorial Zone<br>Abia North | 4 | 30.8 |
| Abia South | 4 | 30.8 |
| Abia Central | 5 | 38.5 |
| **Type of Institution** | | |
| Secondary | 10 | 77 |
| Tertiary | 3 | 23 |
| **Specialty** | | |
| Monospecialty | 0 | 0 |
| Multispecialty | 13 | 100 |
| **Number of dedicated staff in the blood transfusion unit** | | |
| One staff | 7 | 53.8 |
| Two staff | 3 | 23.1 |
| ≥3 | 3 | 23.1 |
| **Active Blood Transfusion Committee** | | |
| Yes | 0 | 0 |
| No | 13 | 100 |
| **Existing Quality policy in the hospital** | | |
| Yes | 2 | 15.38 |
| No | 11 | 84.62 |
| **Quality Officer on blood issues** | | |
| Yes | 0 | 0 |
| No | 13 | 100 |
| **Record that can identify blood donors** | | |
| Yes | 9 | 69.23 |
| No | 4 | 30.77 |
| **Record retrieval for blood donors**<br>Manual | 9 | 100 |
| Computer | 0 | 0 |
| **Voluntary blood recruitment unit** | | |
| Yes | 1 | 7.69 |
| No | 12 | 92.31 |

**Table 1:** Sociodemographic Information

| Equipment | Frequency n = 13 | Percentage (%) |
|---|---|---|
| **Dedicated blood bank** | | |
| Yes | 5 | 38.5 |
| No | 8 | 61.5 |
| **Dedicated Generator** | | |
| Yes | 6 | 46.2 |
| No | 7 | 53.8 |
| **Benchtop Centrifuge** | | |
| Yes | 11 | 84.6 |
| No | 2 | 15.4 |
| **Water bath** | | |
| Yes | 7 | 53.8 |
| No | 6 | 46.2 |
| **Microscope** | | |
| Yes | 13 | 100 |
| No | 0 | 0 |
| **ELISA Equipment** | | |
| Yes | 1 | 7.7 |
| No | 12 | 92.3 |
| **Domestic Freezer** | | |
| Yes | 2 | 15.4 |
| No | 11 | 84.6 |
| **Domestic fridge** | | |
| Yes | 9 | 69.2 |
| No | 4 | 30.8 |
| **Cold centrifuge** | | |
| Yes | 0 | 1 |
| No | 13 | 100 |

**Table 2a:** Blood Transfusion Equipment in the Blood Bank Unit of Health Institutions in Abia State.

| Equipment | Frequency | Percentage (%) |
|---|---|---|
| **Apheresis Machine** | | |
| Yes | 0 | 0 |
| No | 13 | 100 |
| **-20º C Freezer** | | |
| Yes | 0 | 0 |
| No | 13 | 100 |
| **80º C Freezer** | | |
| Yes | 0 | 0 |
| No | 13 | 100 |
| **Platelet agitator** | | |
| Yes | 0 | 0 |
| No | 13 | 100 |
| **Weighing Scale** | | |
| Yes | 3 | 23.1 |
| No | 10 | 76.9 |
| **Bed Couches** | | |
| Yes | 11 | 84.6 |
| No | 2 | 15.4 |
| **First Aid Kits** | | |
| Yes | 0 | 0 |
| No | 13 | 100 |

**Table 2b:** Blood Transfusion Equipment in the Blood Bank Unit of Health Institutions in Abia State

| Variables | Frequency n= 13 | Percentage (%) |
|---|---|---|
| **Availability of Blood Transfusion Equipment** | | |
| Poor Availability (Score: ≤49.9%) | 12 | 92.3 |
| Fair Availability (Score: 50-69.9%) | 1 | 7.7 |
| Adequate (Score: ≥70) | 0 | 0 |

**Table 3:** Assessment of Availability of Blood Transfusion Equipment in Health Institutions in Abia State

| Variables | Frequency | Percentage (%) |
|---|---|---|
| **Are there dedicated qualified staff in the blood bank** | | |
| Yes | 12 | 92.3 |
| No | 1 | 7.7 |
| **Are there adequate staff stationed in the blood bank** | | |
| Yes | 0 | 100 |
| No | 13 | 0 |
| **Consultant Haematologist** | | |
| Yes | 1 | 7.7 |
| No | 12 | 92.3 |
| **Medical Laboratory Scientist [Heamatologist]** | | |
| Yes | 7 | 53.8 |
| No | 6 | 42.6 |
| **Medical Laboratory Scientist[other]** | | |
| Yes | 11 | 84.6 |
| No | 2 | 15.4 |
| **Is the number of Medical Laboratory Scientists Adequate** | | |
| Yes | 0 | 0 |
| No | 13 | 100 |
| **Support staff /other [please specify]** | | |
| **Yes** | 10 | 76.9 |
| No | 3 | 23.1 |
| **Is the number of Support staff adequate** | | |
| Yes | 0 | 0 |
| No | 13 | 0 |
| **Are there the following trained personnel in the Blood Bank** | | |
| **a. Phlebotomist** | | |
| Yes | 3 | 23.1 |
| No | 10 | 76.9 |
| **b. Blood Donor Counsellor** | | |
| Yes | 1 | 7.7 |
| **No** | 12 | 92.3 |
| **c. Blood Recruiter?** | | |
| Yes | 0 | 0 |
| No | 13 | 100 |

**Table 4:** Availability and adequacy of Staff in Blood Bank unit in Abia state.

| Variables | Frequency n= 13 | Percentage (%) |
|---|---|---|
| **Staff Disposition/Availability** | | |
| Poor Availability (Score: ≤49.9%) | 12 | 92.3 |
| Fair Availability (Score: 50-69.9%) | 1 | 7.7 |
| Adequate (Score: ≥70) | 0 | 0 |

The vast majority of the blood banks (92.3%) reported poor staffing availability

**Table 5:** Assessment of Staff disposition/availability in Blood Unit in Abia State unit

| Screening Tests | Frequency | Percentage |
|---|---|---|
| HIV 1&2 done | | |
| Yes | 13 | 100 |
| No | 0 | 0 |
| Screening Methods used | | |
| Rapid test | 13 | 100 |
| * ELISA | 0 | 0 |
| Hepatitis B | | |
| Yes | 13 | 100 |
| No | 0 | 0 |
| Screening Methods used | | |
| Rapid test | 13 | 100 |
| * ELISA | 0 | 0 |
| Hepatis C | | |
| Yes | 13 | 100 |
| No | 0 | 0 |
| | | |
| Screening Methods used | | |
| Rapid test | 13 | 100 |
| * ELISA | 0 | 0 |
| VDRL | | |
| Yes | 13 | 100 |
| No | 0 | 0 |
| Screening Methods used | | |
| Rapid test | 13 | 100 |
| * ELISA | 0 | 0 |
| Available SOP in use | | |
| Yes | 8 | 61.5 |
| No | 5 | 38.5 |

* ELISA = Enzyme-Linked Immunosorbent assay

**Table 6:** Types of screening tests done by methods

## Discussion

The results of this study reveal significant challenges in the blood transfusion services in Abia State, Nigeria, particularly in terms of infrastructure, manpower, and equipment. These challenges are not unique to this region but are common across many low-resource settings, as highlighted in previous studies on blood transfusion services in sub-Saharan Africa [2].

The sociodemographic distribution of the health institutions involved in this study shows that the majority of the institutions (77%) are secondary healthcare facilities, with only 23% being tertiary institutions. This is consistent with the health system structure in Nigeria, where tertiary healthcare centers are fewer in number but tend to serve a larger population due to their specialized services. The predominance of secondary healthcare facilities aligns with the findings of Akeem et al. [16], who observed similar institutional distributions in their study of blood transfusion services in rural parts of Nigeria.

The study also revealed that none of the health institutions had active blood transfusion committees, and only 15.38% had existing quality policies. This indicates a lack of systematic oversight and quality assurance in blood transfusion services, which is critical for the safety and efficiency of these services. Osei et al. [17] stressed the importance of institutionalizing blood transfusion committees in healthcare facilities as part of efforts to improve the safety and quality of blood transfusion services. The absence of these committees in all the surveyed facilities suggests an urgent need for policy reform and enforcement at both institutional and governmental levels.

A critical aspect of the blood transfusion service is the availability of qualified and dedicated personnel. The findings show that while 92.3% of

the institutions had dedicated qualified staff in their blood banks, none had adequate staffing levels. The shortage of essential personnel, including consultant hematologists (only 7.7% of institutions had one), medical laboratory scientists (53.8% had hematologists), and phlebotomists (23.1%), mirrors the workforce challenges reported by Chijoke et al. [18]. Inadequate staffing leads to burnout, reduced quality of care, and increased risks of transfusion errors, as noted by Mohammed and Thomas [19].

The absence of blood recruiters and counsellors in all institutions further exacerbates the difficulties in maintaining a stable blood supply. This is a significant concern, as voluntary blood donation has been shown to improve the safety and availability of blood [20]. Without dedicated staff to educate and recruit voluntary donors, the institutions are likely to rely heavily on paid or family donors, which increases the risk of transfusion-transmitted infections [21].

The study revealed a stark inadequacy in the availability of blood transfusion equipment in health institutions across Abia State. Out of the 16 parameters assessed, only microscopes were available in all the institutions. Critical equipment such as ELISA machines, cold centrifuges, apheresis machines, and -80°C freezers were absent, while only 38.5% of the institutions had dedicated blood banks, and 46.2% had dedicated generators. This lack of essential equipment severely hampers the ability of these institutions to carry out safe and efficient blood transfusions.

The poor availability of blood transfusion equipment (92.3%) is consistent with the findings of Udoma et al. [22], who reported that many healthcare facilities in Nigeria lack the basic infrastructure necessary for safe blood transfusion practices. Without reliable power sources (only 46.2% of institutions had dedicated generators), temperature-sensitive components

such as blood products may be compromised, leading to adverse transfusion reactions. Similarly, the absence of ELISA equipment, which is crucial for screening blood for transfusion-transmissible infections, highlights a critical gap in ensuring blood safety. Instead, all institutions rely on rapid tests, which, while useful for screening, may not be as sensitive as ELISA tests [23].

The findings show that 100% of the institutions screen for HIV, Hepatitis B, Hepatitis C, and syphilis using rapid tests. While this indicates that basic screening protocols are in place, the reliance on rapid testing rather than ELISA for these infections raises concerns about the sensitivity and specificity of the screening methods. Rapid tests, although quick and convenient, may miss low-level infections, especially in high-prevalence areas such as Nigeria. Studies by Tagny et al. [24] and Okoroiwu et al. [25] have shown that the use of ELISA significantly improves the detection of transfusion-transmissible infections, reducing the risk of infecting recipients.

Moreover, only 61.5% of the institutions had standard operating procedures (SOPs) in place, indicating a lack of standardized protocols for blood transfusion practices. The absence of SOPs in 38.5% of institutions could lead to inconsistencies in the screening and handling of blood products, increasing the likelihood of errors and compromising patient safety [26].

The study assessed the adequacy of staff and equipment in blood transfusion units, revealing that none of the institutions had adequate numbers of staff or equipment. The vast majority of the blood banks (92.3%) reported poor staff availability, which correlates with the overall poor state of blood transfusion services in the region. These findings are consistent with studies by Njoku et al. [27], which highlighted that the lack of human resources and essential equipment in blood banks in Nigeria is a major obstacle to safe and effective blood transfusion practices.

The lack of critical equipment, such as platelet agitators, -20°C and -80°C freezers, and apheresis machines, further complicates the ability of these institutions to manage blood products effectively. In developed settings, these machines are essential for processing and storing blood products, particularly for managing patients who require specialized transfusion therapies such as platelet transfusions or plasma exchange [28]. The complete absence of these machines in Abia State indicates a serious gap in the infrastructure necessary for comprehensive transfusion services.

## Conclusion

The results of this study highlight severe challenges in blood transfusion services in Abia State, with major gaps in infrastructure, manpower, and equipment. The findings align with previous studies that have pointed out similar deficiencies across Nigeria and sub-Saharan Africa. Addressing these challenges will require concerted efforts from policymakers, healthcare providers, and international organizations to improve the availability of trained personnel, enhance the procurement and maintenance of essential equipment, and ensure the implementation of standardized protocols for safe blood transfusion practices.

## Recommendations

1. **Enhancement of Infrastructure and Equipment:** There is a critical need to equip blood banks with standard facilities, including proper blood storage equipment like -20°C and -80°C freezers and blood agitators. Ensuring that all institutions have access to standard blood banks will significantly improve the safety and reliability of blood transfusions.

2. **Staffing and Training:** Health institutions should prioritize hiring qualified and adequate staff for blood transfusion services. Regular and scheduled training programs should be implemented to keep the staff updated on best practices in blood transfusion and management.

3. **Establishment of Active Blood Transfusion Committees:** Every health institution should establish an active blood transfusion committee and implement comprehensive quality policies to oversee blood transfusion practices, ensuring compliance with national standards and guidelines.

4. **Improvement in Record Keeping:** The adoption of computerized systems for donor record-keeping is recommended to enhance the accuracy and efficiency of donor tracking and blood inventory management.

5. **Regular Monitoring and Evaluation:** The Ministry of Health should conduct regular audits and assessments of blood transfusion services to ensure that all institutions adhere to established protocols and standards, with a focus on continuous improvement.

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