Available online at *www.ujpronline.com*
Universal Journal of Pharmaceutical Research
An International Peer Reviewed Journal
ISSN: 2831-5235 (Print); 2456-8058 (Electronic)

REVIEW ARTICLE

BLOOD BANKING SYSTEMS IN AFRICA: CHALLENGES, INNOVATIONS, AND RECOMMENDATIONS FOR STRENGTHENING BLOOD BANKING SYSTEMS IN AFRICA – A NARRATIVE REVIEW

Emmanuel Ifeanyi Obeagu[1], Rihab Aref Alsadi[2]
[1]*Department of Biomedical and Laboratory Science, Africa University, Zimbabwe.*
[2]*Department of Pyschology, Al Istiqlal University, Jericho, Palestine.*

Article Info:

Article History:
Received: 6 April 2025
Reviewed: 9 May 2025
Accepted: 21 June 2025
Published: 15 July 2025

Cite this article:
Obeagu EI, Alsadi RA. Blood banking systems in Africa: Challenges, innovations, and recommendations for strengthening blood banking systems in Africa – A narrative review. Universal Journal of Pharmaceutical Research 2025; 10(3): 52-58.
http://doi.org/10.22270/ujpr.v10i3.1359

***Address for Correspondence:**
Dr. Emmanuel Ifeanyi Obeagu, Department of Biomedical and Laboratory Science, Africa University, Zimbabwe. Tel: +234 803 736 9912; E-mail: *emmanuelobeagu@yahoo.com*

Abstract

Blood banking systems in Africa are critical to addressing the healthcare needs of millions of people, particularly in emergencies, maternal care, and chronic conditions like sickle cell disease. However, the region faces significant challenges that limit the availability and safety of blood, including inadequate infrastructure, financial constraints, insufficient training, and low public awareness about voluntary blood donation. These issues lead to blood shortages, placing immense pressure on healthcare providers and resulting in preventable morbidity and mortality. Despite these challenges, there have been several innovative efforts to improve blood banking systems in Africa. Mobile blood collection units, low-cost blood screening technologies, and national awareness campaigns have demonstrated positive outcomes, increasing access to safe blood, especially in rural and underserved areas. These innovations, combined with the establishment of regional blood transfusion services, have helped to overcome some of the logistical and financial barriers to blood collection and distribution.

Keywords: Africa, blood banking, challenges, innovations, recommendations.

INTRODUCTION

Blood transfusion is a critical aspect of healthcare that saves millions of lives worldwide, particularly in emergencies, surgeries, and the management of chronic conditions such as sickle cell disease and anemia. In Africa, blood banking systems are essential to providing safe blood for patients in need. However, these systems face numerous challenges that hinder the timely and safe delivery of blood, including limited infrastructure, financial constraints, and insufficient public awareness. The demand for blood in Africa is significant, but the supply often falls short due to these limitations, resulting in a serious public health concern[1,2]. One of the primary challenges facing blood banks in Africa is inadequate infrastructure. Many African countries do not have sufficient blood collection centers, laboratories, or storage facilities to support the safe collection, screening, and storage of blood. Without proper refrigeration, blood cannot be stored for extended periods, limiting its availability for transfusion. In addition, blood banks often lack the necessary equipment and supplies, such as blood bags, reagents for screening infectious diseases, and quality control tools, which compromises the safety and efficacy of the blood supply[3,4]. Financial constraints further exacerbate these challenges, with many African governments allocating limited budgets to healthcare services, including blood banking. Blood banks are often underfunded, resulting in a lack of resources for necessary operations, such as maintaining stock, training personnel, and upgrading facilities. This financial instability makes it difficult for blood banks to meet the growing demand for blood, especially in the face of ongoing health crises such as the COVID-19 pandemic, which has further strained healthcare systems across the continent[5,6].

Inadequate training and a shortage of skilled personnel also contribute to the inefficiencies in blood banking. Healthcare professionals, including those managing blood banks, often lack the necessary training and education to ensure the safe collection, processing, and storage of blood[7]. This shortage of trained staff impacts the quality of blood transfusion services and can lead to

avoidable complications, such as blood contamination or errors in blood matching. Moreover, the lack of consistent professional development programs limits the capacity of health workers to keep up with the latest best practices and technologies in blood banking[8,9]. The issue of public awareness and blood donation practices is another significant challenge in Africa. Many countries rely heavily on family replacement donations, which are less reliable than voluntary, non-remunerated donations. Cultural barriers, misconceptions about the safety of blood transfusions, and fear of HIV transmission through transfusions contribute to a reluctance to donate blood. This shortage of voluntary donors, combined with the limited education on the importance of regular blood donation, perpetuates the crisis of insufficient blood supply[10,11]. However, despite these challenges, there have been notable efforts and innovations to address the blood banking crisis in Africa. Mobile blood collection units have been introduced in many countries to reach rural and remote populations where blood banks are scarce. These mobile units, equipped with the necessary tools for blood collection and screening, have proven successful in improving the availability of blood in underserved areas. By bringing blood donation services directly to communities, these units help overcome geographic barriers and increase the number of blood donations[12,13].

Another innovation is the introduction of low-cost technologies for blood screening. In many African countries, rapid diagnostic tests for infectious diseases such as HIV, Hepatitis B and C, and syphilis have been implemented to improve the safety of the blood supply. These tests allow blood banks to quickly screen donated blood for infectious agents without relying on expensive laboratory equipment. By incorporating these affordable diagnostic tools, blood banks can ensure that blood transfusions are safer and reduce the risk of transmitting diseases through transfusions[14,15]. In addition to technological innovations, blood banks in Africa have increasingly relied on national blood transfusion services to standardize blood collection, screening, and distribution. These services provide centralized management of blood stocks, ensuring equitable distribution across the country and reducing disparities in access to blood. National blood transfusion services also help coordinate public awareness campaigns and donor recruitment efforts, further promoting voluntary blood donation and enhancing the overall effectiveness of blood banking systems[16]. Despite these positive steps, there is still much to be done to improve blood banking systems in Africa. A comprehensive approach is needed, one that combines innovations in technology with increased investment in infrastructure, education, and policy reform. Governments, healthcare organizations, and international partners must work together to address the challenges facing blood banking systems and ensure that safe blood is available for all those in need[17].

This review aims to provide an overview of the challenges, innovations, and recommendations for improving blood banking systems in Africa.

The justification for this review stems from the critical role that blood banking systems play in the healthcare infrastructure of any country, and particularly in Africa, where the demand for blood transfusions is rising, while the supply remains insufficient in many regions. Blood is essential for a variety of medical interventions, including surgeries, trauma care, maternal health, and the management of chronic conditions such as sickle cell disease, anemia, and malaria. However, despite the growing need, African blood banks face several challenges, such as inadequate infrastructure, low donation rates, limited access to safe blood, and financial constraints. This review aims to address these issues by providing a comprehensive analysis of the current state of blood banking in Africa, highlighting key challenges, identifying innovative solutions, and proposing actionable recommendations for strengthening blood banking systems across the continent[1-3]. In addition, while many studies have explored aspects of blood banking in individual African countries, there is a lack of a comprehensive review that synthesizes data across the continent. By examining various innovations, such as mobile blood units, digital platforms for donor recruitment, and improved screening technologies, this review identifies scalable solutions that can be adopted across diverse African healthcare systems.

Furthermore, by proposing strategies to overcome barriers to blood collection, donation, and distribution, the review aims to provide a roadmap for enhancing blood safety, availability, and access. This is crucial in ensuring that the demand for blood in emergencies, surgeries, and chronic disease management is met, thereby improving patient outcomes and saving lives[4-6]. Lastly, this review seeks to contribute to the ongoing discourse on healthcare system strengthening in Africa, particularly in the context of blood banking. The findings and recommendations provided herein can guide policymakers, healthcare professionals, and organizations working on improving blood supply systems, facilitating collaboration, and fostering a sustainable approach to blood banking. By focusing on the unique challenges and potential solutions within the African context, this review seeks to promote a more resilient and effective blood banking infrastructure, which is essential for the overall improvement of public health in the region.

METHODOLOGY

Literature Search Strategy

A comprehensive literature search was conducted through multiple databases, including: PubMed, Google Scholar, Scopus, African Journals Online (AJOL), World Health Organization (WHO) databases. Keywords such as **"**Blood Banking in Africa", **"**Blood Donation", "Blood Transfusion Challenges", **"**Blood Safety Africa", **"**Innovations in Blood Banking," and **"**Public Health in Africa" were used to identify relevant studies, reports, and publications. The literature search was not restricted by publication date, though preference was given to more recent

publications to reflect current trends and technological advancements in blood banking.

Challenges in blood banking systems in Africa

Blood banking systems in Africa face numerous challenges that significantly affect the availability, safety, and efficiency of blood transfusions. These challenges are multifaceted, ranging from infrastructure deficits to social and cultural barriers. The following are some of the key challenges in blood banking systems across the continent.

Inadequate infrastructure

One of the most significant challenges facing blood banking in Africa is inadequate infrastructure. Many countries lack sufficient blood collection centers and processing facilities, which are essential for ensuring the safe collection, storage, and distribution of blood. In regions where blood banks do exist, they often suffer from outdated or malfunctioning equipment, including refrigeration units necessary to maintain blood at appropriate temperatures. Inadequate storage facilities mean that blood cannot be stored for extended periods, leading to waste and making it difficult to ensure a steady supply, especially in remote or rural areas[18].

Financial constraints

Financial limitations are another primary challenge in blood banking systems in Africa. Health budgets in many African countries are limited, and blood banks often receive insufficient funding to support their operations. This financial constraint hampers blood collection efforts, including the procurement of essential materials such as blood bags, screening reagents, and equipment for blood processing. Without the necessary funding, blood banks may struggle to maintain basic operations and infrastructure, leading to shortages in the blood supply, compromised safety, and inability to respond adequately to emergency situations[19].

Shortage of skilled personnel

There is a severe shortage of trained professionals in the field of blood banking across Africa. Many blood banks are understaffed or lack specialized personnel who are qualified to perform crucial tasks such as blood collection, screening, and storage. The lack of skilled labor results in poor management of blood inventory, improper storage techniques, and inaccurate blood testing. Additionally, there is often a lack of ongoing professional development and training programs, leaving staff without the most current knowledge and skills in blood banking practices. This shortage of qualified personnel not only affects the safety and quality of blood transfusions but also impacts the efficiency of blood banking systems[20].

Inadequate blood donation awareness

Public awareness around blood donation remains limited in many parts of Africa. Cultural factors, such as stigma or misinformation about the safety of blood transfusions, often lead to reluctance among individuals to donate blood. Additionally, there is a widespread dependence on family replacement donations, where blood is provided only when a patient has a need for a transfusion. This system is less reliable and sustainable compared to voluntary, non-remunerated blood donations. The low number of regular, voluntary blood donors contributes to blood shortages, particularly during emergencies or peak demand periods[21].

Challenges with blood safety and screening

Blood safety is a significant concern in African blood banks, especially considering the high prevalence of infectious diseases such as HIV, Hepatitis B and C, and syphilis across the continent. Many blood banks lack sufficient resources for comprehensive screening of donated blood, increasing the risk of transmission of blood-borne infections. The cost of advanced screening technologies is often prohibitive, and while some countries have introduced rapid diagnostic tests, these are not universally available or accessible. Inadequate screening of blood donations can result in unsafe blood being transfused to patients, putting them at risk of serious health complications[21].

Geographic and logistic barriers

Geographic barriers and poor transportation infrastructure complicate the collection and distribution of blood, particularly in rural and remote areas. Blood banks are often located in urban centers, making it difficult for people in remote regions to access blood donations or transfusions when needed. The logistical challenges of transporting blood across long distances, particularly under time-sensitive conditions, further exacerbate the problem. These barriers often lead to regional disparities in access to blood, with certain populations experiencing chronic shortages, while others may have a more stable supply[22].

Regulatory and policy gaps

There is a lack of standardized regulatory frameworks governing blood banking in many African countries. Inconsistent policies, inadequate quality control measures, and a lack of regulatory oversight contribute to inefficiencies in the collection, storage, and distribution of blood. Some countries have yet to implement national blood transfusion services, which means there is no centralized system to manage blood resources. Additionally, the absence of proper accreditation systems for blood banks often results in substandard practices and compromises blood safety[23].

Impact of political and social instability

Political instability and conflicts in certain African countries further complicate the functioning of blood banking systems. Armed conflicts, civil wars, and displacement of populations can disrupt blood collection and distribution services, making it difficult for humanitarian aid efforts to reach the most vulnerable populations. In regions affected by conflict, health systems are often overwhelmed, and blood banks may be destroyed or unable to function properly. This not only exacerbates the lack of blood but also impedes any efforts to build a sustainable blood banking infrastructure in the affected areas[24-26].

Technological limitations

Despite advances in technology globally, many African blood banks still rely on outdated or manual processes for blood collection and management. The lack of automation in blood testing, screening, and inventory management increases the chances of human error and slows down the blood donation process. In some cases,

blood banks rely on paper-based systems for tracking blood donations, inventory, and patient needs, which is time-consuming and prone to errors. The introduction of more advanced digital tools for blood tracking and inventory management could improve the efficiency and safety of blood banks in Africa[27,28].

Challenges during public health emergencies

The challenges faced by blood banks in Africa are amplified during public health emergencies, such as disease outbreaks and pandemics. The COVID-19 pandemic, for example, led to disruptions in blood collection as public gatherings were restricted, and blood donation events were canceled or postponed. In such situations, the need for blood increases while the ability to collect it diminishes, further exacerbating the blood shortage crisis. Moreover, healthcare systems in many African countries are already overburdened, leaving little room for efficient management of blood supplies during emergencies[29,30].

Innovations in blood banking systems in Africa

Innovations in blood banking systems across Africa have emerged in response to the numerous challenges faced by the continent in ensuring the availability and safety of blood for transfusion. These innovations range from technological advancements to strategic initiatives aimed at improving efficiency, safety, and access to blood. By adopting new approaches and technologies, blood banks in Africa have begun to improve their operations and overcome some of the key barriers to effective blood collection and distribution. Below are some notable innovations in African blood banking systems.

Mobile blood collection units

One of the most significant innovations in blood banking across Africa has been the introduction of mobile blood collection units. These mobile units are equipped with the necessary facilities to collect, screen, and store blood in remote or rural areas where permanent blood banks are scarce. Mobile blood units are especially effective in reaching underserved populations, increasing blood donations, and improving the geographical spread of blood supplies. By traveling to rural communities, these units break down the geographical barriers that hinder access to blood, making it easier for individuals in remote areas to donate blood and for hospitals to receive the blood they need[31].

Low-cost blood screening technologies

Blood safety is a major concern in Africa, where infectious diseases such as HIV, Hepatitis B and C, and syphilis are prevalent. To address this, blood banks have started adopting low-cost blood screening technologies that can be used to test for these and other blood-borne pathogens. Rapid diagnostic tests (RDTs) have become increasingly common in African blood banks due to their affordability, speed, and ease of use. These tests allow blood banks to quickly and efficiently screen donated blood, ensuring that it is safe for transfusion. The use of RDTs has reduced the financial burden on blood banks and improved the safety of the blood supply, especially in resource-limited settings[32].

National Blood Transfusion Services

Many African countries have established or strengthened national blood transfusion services (NBTS) as a means to improve the organization and management of blood banks. These services centralize the collection, screening, storage, and distribution of blood, ensuring a more equitable distribution of blood across regions. NBTSs help manage blood supply chains, set standards for blood collection, and promote voluntary non-remunerated blood donation. By having a national body overseeing blood transfusion services, countries can improve the coordination of blood collection campaigns, ensure consistent blood availability, and reduce regional disparities in access to blood[33].

Public awareness campaigns

Public awareness campaigns have proven to be an effective tool for increasing voluntary blood donations in Africa. Many countries have launched national and local campaigns to educate the public on the importance of blood donation, the safety of blood transfusions, and how to become a regular blood donor. These campaigns are often held during key events or special days such as World Blood Donor Day, and they use a variety of media platforms, including radio, television, and social media, to spread their messages. Increased public education has helped to dispel myths and misconceptions about blood donation, encouraging more people to donate voluntarily and regularly[24].

Partnerships with the private sector

Public-private partnerships have become an important innovation in blood banking across Africa. By collaborating with private companies, blood banks can gain access to additional resources, such as funding, technology, and logistics support. In some cases, private companies have donated blood collection equipment or contributed to the development of mobile blood collection units. These partnerships can also help improve the management of blood stock inventories and enable better data tracking and monitoring. Through these collaborations, blood banks are able to leverage private sector expertise and resources to improve the efficiency and sustainability of blood banking systems[34].

Integration of digital technologies

Digital technologies have begun to play a key role in modernizing blood banking systems in Africa. The use of mobile applications, software systems, and electronic databases to manage blood inventory, track donations, and monitor patient needs is becoming more common. These digital platforms enable blood banks to more accurately track the movement of blood from donation to transfusion, ensuring that blood is allocated where it is needed most. Additionally, digital technologies help streamline administrative processes, reducing the burden on staff and improving operational efficiency. Some systems also include features that allow donors to track their donation history, making it easier for them to know when they are eligible to donate again[35].

Innovations in blood storage and transport

Innovations in blood storage and transport have been critical in ensuring the safety and availability of blood

for transfusion. For example, the development of portable and energy-efficient refrigerators has made it easier to store blood at safe temperatures, even in regions with unreliable electricity supply. New blood storage technologies, such as longer-lasting blood bags and blood preservation solutions, have extended the shelf life of donated blood, reducing waste and improving blood availability. Innovations in transport logistics, such as temperature-controlled blood transport vehicles, ensure that blood remains safe during transit, even over long distances[36].

Enhanced blood donation drive models

To address the chronic shortage of blood in Africa, blood banks have adopted innovative models for blood donation drives. One such model is the organization of regular blood donation events at schools, universities, workplaces, and community centers. These events are strategically planned to encourage large numbers of people to donate at one time, making the blood collection process more efficient. Additionally, some countries have implemented blood donation targets and work with local leaders and organizations to set up blood donation hubs in communities, which increases the regularity of blood donation campaigns and expands access to blood[37].

Blood donation register and loyalty programs

Some blood banks in Africa have introduced blood donation registers and loyalty programs to encourage repeat donations. These systems maintain a database of donors, allowing blood banks to track individuals' donation history and remind them when they are due for their next donation. Loyalty programs offer incentives, such as certificates or small rewards, to encourage people to donate blood regularly. By creating a community of loyal blood donors, these programs contribute to building a sustainable supply of blood and ensure that blood is available when needed[38].

Blood donation and transfusion data analytics

Data analytics has become an innovative tool for improving the management of blood banking systems in Africa. By using data analytics to track trends in blood donation, usage, and demand, blood banks can better forecast the need for blood and optimize their inventory management. These systems can also help identify areas with chronic blood shortages and highlight regions where blood donation campaigns are needed. Data-driven insights are crucial for improving the efficiency of blood banks and ensuring that blood is available for patients who need it most[38].

Recommendations for strengthening blood banking systems in Africa

Strengthening blood banking systems in Africa is essential to meet the growing demand for safe and sufficient blood supply for medical procedures, especially in regions with high disease burdens and limited healthcare infrastructure. Given the current challenges and opportunities for innovation in blood banking across the continent, the following recommendations are proposed to enhance the effectiveness and sustainability of blood banking systems in Africa.

1. Strengthen blood donation awareness campaigns

Raising awareness about the importance of voluntary, non-remunerated blood donation is crucial. Governments, NGOs, and health organizations should invest in nationwide education campaigns to promote blood donation as a civic responsibility. Public education efforts should target schools, universities, workplaces, and community centers to encourage regular and voluntary donations. These campaigns should also work to dispel myths about blood donation, highlight its benefits, and address any fears or misconceptions. Additionally, the focus should be on maintaining a consistent donor base through frequent donation drives and engaging social media platforms to reach wider populations.

2. Develop robust blood donation infrastructure

Many African countries suffer from inadequate infrastructure for blood collection, storage, and distribution. To address this, it is crucial to invest in the development of dedicated blood donation centers, blood banks, and mobile units. These facilities should be equipped with modern technologies to ensure blood is safely collected, stored, and transported. Mobile blood collection units should be expanded to reach rural and underserved populations, ensuring that no region is left behind. Improving access to these facilities can help bridge the gap between blood supply and demand, particularly in remote or marginalized communities.

3. Improve blood screening and safety protocols

Blood safety remains a significant challenge in Africa due to the prevalence of infectious diseases such as HIV, Hepatitis B and C, and syphilis. To mitigate the risks associated with unsafe blood transfusions, it is essential to improve blood screening protocols across the continent. Blood banks should adopt affordable, rapid diagnostic tests for blood-borne pathogens, which can help ensure the safety of donated blood. Investment in automated and standardized screening technologies should be prioritized to improve accuracy and reduce the manual errors associated with blood testing. Additionally, developing better guidelines for blood transfusion practices and donor selection will improve safety standards.

4. Promote public-private partnerships

Public-private partnerships (PPPs) can be instrumental in strengthening blood banking systems in Africa. Collaborations with private sector entities such as pharmaceutical companies, logistics providers, and technology firms can enhance the capacity and efficiency of blood banking operations. The private sector can offer expertise in managing supply chains, developing technologies for blood screening and storage, and improving logistics. Additionally, blood banks can benefit from private funding to procure equipment and technology that may be otherwise difficult to afford. Strategic PPPs can also provide access to resources such as blood donation campaigns, corporate sponsorships, and volunteer mobilization.

5. Standardize blood collection and transfusion practices

To ensure that blood banks across Africa operate efficiently and provide a consistent supply of safe

blood, there is a need for standardized protocols and guidelines for blood collection, storage, and transfusion practices. Establishing a national framework for blood donation systems and implementing training programs for medical professionals, blood bank staff, and donors will ensure that best practices are followed across all levels. Standardizing these processes across African nations would also improve the coordination between different regions, ensuring a more equitable distribution of blood supplies. National and international organizations can play a pivotal role in supporting the adoption of these standards.

6. Integrate digital technologies in blood banking operations

Leveraging digital technologies can revolutionize blood banking systems in Africa. Blood banks should adopt electronic health records, inventory management systems, and data analytics tools to streamline operations and reduce inefficiencies. Digital platforms can be used to track the donation history of individuals, monitor blood stocks, and predict future needs based on trends in healthcare demands. Additionally, the use of mobile applications can help connect donors with blood banks, provide reminders for future donations, and facilitate easy registration. These digital tools can enhance coordination, reduce waste, and improve transparency in blood banking systems.

7. Enhance training and capacity building for blood bank personnel

To ensure that blood banks operate at maximum efficiency, it is crucial to invest in the continuous training and professional development of staff involved in blood banking operations. Blood bank personnel should be trained in modern blood collection techniques, screening procedures, safe storage practices, and transfusion protocols. A well-trained workforce is key to the sustainability and success of blood banking systems, ensuring that high-quality blood products are consistently available.

8. Strengthen National Blood Transfusion Services

National Blood Transfusion Services (NBTS) play a central role in the coordination, regulation, and management of blood donation activities. Strengthening these services is essential to ensure the efficient operation of blood banks and to provide a framework for policy development. Governments should prioritize the development of strong, centrally coordinated blood transfusion systems that can standardize practices, manage supplies, and ensure blood is distributed equitably across the country.

9. Foster regional cooperation and collaboration

Given the global and regional nature of healthcare challenges, African countries should promote greater cooperation between regional blood transfusion services. Collaboration between neighboring countries can facilitate the sharing of resources, best practices, and knowledge, allowing countries to tackle common challenges in blood banking together. Joint blood donation campaigns, regional blood reserves, and shared technologies can help optimize the use of available resources and reduce blood shortages. Regional collaboration will also allow for the pooling of expertise, ensuring that blood banking systems are aligned with international standards.

10. Secure sustainable funding for blood banking initiatives

Finally, securing sustainable funding for blood banking systems is essential for long-term success. Governments, international organizations, and private sector partners should invest in blood banking infrastructure and operations to ensure the sustainability of blood donation services. Funding should be allocated to critical areas such as the procurement of equipment, training of staff, development of mobile units, and public awareness campaigns. Additionally, innovative funding models such as donor-supported programs, crowd funding, or health insurance schemes can be explored to ensure that blood banking systems are adequately funded in the long term.

CONCLUSIONS

Strengthening blood banking systems in Africa is a critical step toward improving healthcare delivery and ensuring access to safe blood for transfusions. While the challenges are significant, including limited infrastructure, low donor rates, and issues with blood safety, there are clear opportunities for innovation and improvement. Through public awareness campaigns, investment in modern blood collection and storage technologies, and the establishment of strong public-private partnerships, blood banking systems can be enhanced to better meet the needs of African populations. By adopting these recommendations, Africa can develop resilient and efficient blood banking systems that will significantly improve patient care and contribute to overall health improvements.

ACKNOWLEDGEMENTS

The author would like to thank Africa University, Zimbabwe to provide necessary facilities for this work.

AUTHOR'S CONTRIBUTION

Obeagu EI: conceived the idea, writing the manuscript, literature survey. **Alsadi RA:** formal analysis, critical review. Final manuscript was checked and approved by the both authors.

DATA AVAILABILITY

Data will be made available on request.

CONFLICT OF INTEREST

There are no conflicts of interest in regard to this project.

REFERENCES

1. Rambiritch V, Vermeulen M, Bell H, *et al.* Education subcommittee of the AABB global transfusion forum. Transfusion medicine and blood banking education and

training for blood establishment laboratory staff: A review of selected countries in Africa. transfusion 2021; 61(6):1955-1965. *https://doi.org/10.1111/trf.16372*

2. Adewumi A, Budlender N, Olusanya M. Optimizing the assignment of blood in a blood banking system: Some initial results. In 2012 IEEE congress on evolutionary computation 2012: 1-6. IEEE. *https://doi.org/10.1109/CEC.2012.6256633*
3. Gallaher JR, Mulima G, Kopp D, *et al.* Consequences of centralised blood bank policies in Sub-Saharan Africa. Lan Glob Health 2017; 5(2):e131-132. *https://doi.org/10.1016/S2214-109X(16)30364-3*
4. Bloch EM, Vermeulen M, Murphy E. Blood transfusion safety in Africa: A literature review of infectious disease and organizational challenges. Trans Med Rev 2012; 26(2):164-180. *https://doi.org/10.1016/j.tmrv.2011.07.006*
5. Jacobs B, Mercer A. Feasibility of hospital-based blood banking: A Tanzanian case study. Health Pol plann 1999; 14(4):354-362. *https://doi.org/10.1093/heapol/14.4.354*
6. Osaro E, Charles AT. The challenges of meeting the blood transfusion requirements in Sub-Saharan Africa: The need for the development of alternatives to allogenic blood. J Blood Med 2011:7-21. *https://doi.org/10.2147/JBM.S17194*
7. Sifueli P. Blood banking in the United Republic of Tanzania. Trans Aphe Sci 2023; 62(5). *https://doi.org/10.1016/j.transci.2023.103799*
8. Olusanya MO, Arasomwan MA, Adewumi AO. Particle swarm optimization algorithm for optimizing assignment of blood in blood banking system. Com Math Meth Med 2015; 2015(1):713898. *https://doi.org/10.1155/2015/713898*
9. Govender P, Ezugwu AE. Boosting symbiotic organism search algorithm with ecosystem service for dynamic blood allocation in blood banking system. J Exp Theor AI 2022; 34(2):261-293. *https://doi.org/10.1080/0952813X.2021.1871665*
10. Chima SC, Mamdoo F. Ethical and regulatory issues surrounding umbilical cord blood banking in South Africa. Sout Afr J Bioeth Law 2011; 4(2):79-84.
11. Allain JP, Owusu-Ofori S, Bates I. Blood transfusion in Sub-Saharan Africa. Trans Alt Trans Med 2004; 6(1):16-23. *https://doi.org/10.1111/j.1778-428X.2004.tb00108.x*
12. Dei EN, Ansah JK. Blood banking: The situation in Ghana. Trans Aphe Sci 2023; 62(5). *https://doi.org/10.1016/j.transci.2023.103803*
13. Tapko JB, Mainuka P, Diarra-Nama AJ, World Health Organization. Status of blood safety in the WHO African region: Report of the 2006 survey. World Health Organization. Regional Office for Africa 2009.
14. Rock G, Åkerblom O, Berséus O, *et al.* The supply of blood products in 10 different systems or countries. Trans Sci 2000 Jun 1;22(3):171-182
15. Barro L, Drew VJ, Poda GG, Tagny CT, El-Ekiaby M, Owusu-Ofori S, Burnouf T. Blood transfusion in sub-Saharan Africa: Understanding the missing gap and responding to present and future challenges. Vox Sanguinis 2018; 113(8):726-736. *https://doi.org/10.1111/vox.12705*
16. Pitman JP, Wilkinson R, Liu Y, *et al.* Blood component use in a Sub-Saharan African country: Results of a 4-year evaluation of diagnoses associated with transfusion orders in Namibia. Trans Med Rev 2015; 29(1):45-51. *https://doi.org/10.1016/j.tmrv.2014.11.003*
17. Raj SP, Vermeulen M, Swanevelder R, *et al.* Blood banking in South Africa. Trans Aph Sci 2023; 62(5). *https://doi.org/10.1016/j.transci.2023.103794*
18. Mohammed AD, Ntambwe P, Crawford AM. Barriers to effective transfusion practices in limited-resource settings: From infrastructure to cultural beliefs. World J Sur 2020; 44:2094-2099.*https://doi.org/10.1007/s00268-020-05461-x*
19. Mpuntsha L, Reddy R. Organizing a national blood service with limited resources–developments in the South African national blood service. ISBT Sci Ser 2015; 10(S1):343-348. *https://doi.org/10.1111/voxs.12126*
20. Schneidman M, Dacombe RJ, Carter J. Laboratory professionals in Africa: The backbone of quality diagnostics. World Bank, Washington, DC 2014. *https://doi.org/10.13140/RG.2.1.2297.1600*
21. Shi L, Wang JX, Stevens L, Ness P, Shan H. Blood safety and availability: Continuing challenges in China's blood banking system. Transfusion 2014; 54(2):471-482. *https://doi.org/10.1111/trf.12273*
22. Bloch EM, Vermeulen M, Murphy E. Blood transfusion safety in Africa: A literature review of infectious disease and organizational challenges. Trans MED REV 2012; 26(2):164-180. *https://doi.org/10.1016/j.tmrv.2011.07.006*
23. Custer B, Zou S, Glynn SA, *et al.* Addressing gaps in international blood availability and transfusion safety in low-and middle-income countries: A NHLBI workshop. Trans 2018; 58(5):1307-1317. *https://doi.org/10.1111/trf.14598*
24. Obeagu EI. Exploring hemovigilance in blood transfusion for HIV-positive individuals: A review. Elit J Haem 2024; 2 (4).:36-50.
25. Obeagu EI, Adias TC. HIV and transfusion medicine: Insights into donor screening and blood safety. Life Haem 2024;2(2):7-15.
26. Obeagu EI, Obeagu GU, Ezeonwumelu JO. Safety and efficacy of blood transfusions in pregnant women. Elit J Haem 2024; 2 (3):96-106.
27. Obeagu EI, Anyanwu CN, Obeagu GU. Challenges and considerations in managing blood transfusion for individuals with HIV. Elit J HIV 2024;2(2):1-7.
28. Obeagu EI, Obeagu GU, Obiezu J, *et al.* Hematologic support in HIV patients: Blood transfusion strategies and immunological considerations.
29. Obeagu EI. Mitigating the impact of HIV on organ function: Blood transfusions as a therapeutic strategy. Int J Med Sci Pharm Res 2024 Sep 15;10(3):23-8. *https://doi.org/10.22270/ijmspr.v10i3.110*
30. Obeagu EI, Obeagu GU. Thriving futures: The holistic benefits of blood transfusions for individuals with HIV. Elit J Pub Health 2024;2(8):31-43.
31. Sifueli P. Blood banking in the United Republic of Tanzania. Trans Apher Sci 2023; 62(5).
32. Ombelet S, Barbé B, Affolabi D, *et al.* Best practices of blood cultures in low-and middle-income countries. Front Med 2019; 6:131.*https://doi.org/10.3389/fmed.2019.00131*
33. Patidar GK, Thachil J, Dhiman Y, *et al.* ISBT convalescent plasma working group. Management of blood transfusion services in low-resource countries. Vox Sang 2022; 117(12):1375-1383. *https://doi.org/10.1111/vox.13373*
34. Parco S, Vascotto F, Visconti P. Public banking of umbilical cord blood or storage in a private bank: Testing social and ethical policy in northeastern Italy. J Blood Med 2013:23-29. *https://doi.org/10.2147/JBM.S41532*
35. Müller HM, Reuter-Oppermann M. Designing behavior change support systems targeting blood donation behavior. Bus Inform Sys Eng 2024:1-21. *https://doi.org/10.1007/s12599-024-00878-3*
36. Raykar NP, Raguveer V, Abdella YE, *et al.* Innovative blood transfusion strategies to address global blood deserts: A consensus statement from the blood delivery via emerging strategies for emergency remote transfusion (blood DESERT) coalition. Lan Glob Health 2024; 12(3):e522-529. *https://doi.org/10.1016/S2214-109X(23)00564-8*
37. World Health Organization. Universal access to safe blood transfusion. World Health Organization 2008.
38. World Health Organization. Towards 100% voluntary blood donation: A global framework for action 2010.