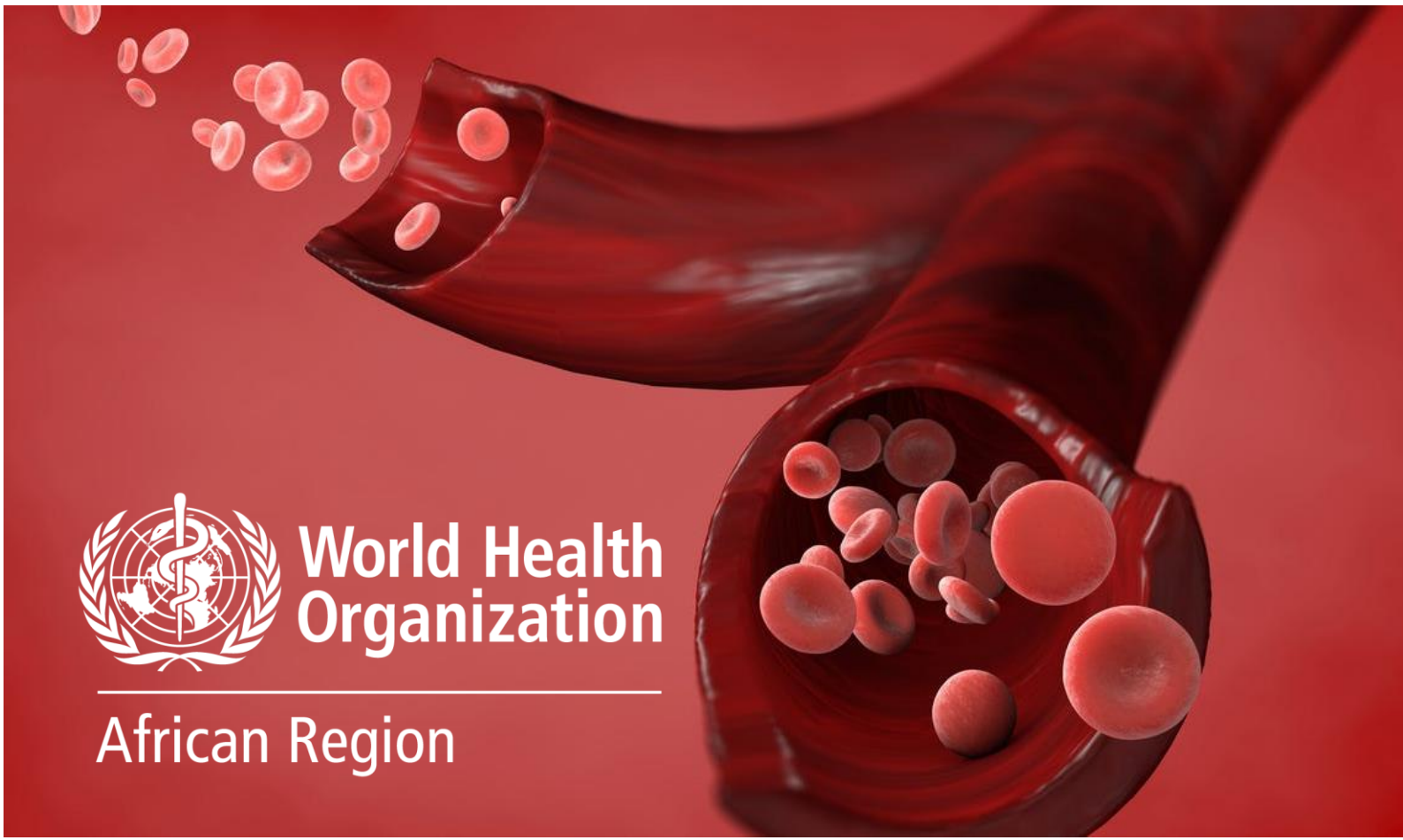
WHO AFRICAN REGION STATUS REPORT ON BLOOD AVAILABILITY, SAFETY AND QUALITY



WHO AFRICAN REGION STATUS REPORT ON BLOOD AVAILABILITY, SAFETY AND QUALITY

WORLD HEALTH ORGANIZATION
REGIONAL OFFICE FOR AFRICA
BRAZZAVILLE —2022

WHO African Region status report on blood availability, safety and quality

ISBN: 978-929023481-4

Suggested citation. WHO African Region status report on blood availability, safety and quality. Brazzaville: WHO Regional Office for Africa; 2022. Licence: CC BY-NC-SA 3.0 IGO.

Cataloguing-in-Publication (CIP) data. CIP data are available at http://apps.who.int/iris.

Designed in Brazzaville, Republic of Congo

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ACKNOWLEDGMENTS

The current WHO African Region status report on blood availability, safety and quality was produced under the coordination and guidance of André LOUA, Technical Officer Blood for Safety and Organ Transplant at WHO Regional Office for Africa. WHO acknowledges the contributions of all directors of national blood transfusion services (NBTS) listed below and of senior staff of the ministries of health in the Member States of the WHO African Region.

WHO thanks Professor Claude TAGNY TAYOU, professor of haematology and blood transfusion at the Faculty of Medicine of the University of Yaoundé I, Cameroon, for his contribution to the development of this report as a consultant.

We thank Dr Diana TAGUEMBOU, Technical Officer, Essential Medicine and Health Technologies, Medicines and Traditional Medicine (MIM), for her participation in data collection and compilation.

Country	**Name of NBTS manager**
Algeria	Dr Ould Kablia Karima Linda
Angola	Mr Deodete Machado
Benin	Dr Orou Bagou Yorou Chabi
Botswana	Mr Koobiditse Radisowa
Burkina Faso	Dr Téwendé Céline Alice Rosine Kiba Koumare
Burundi	Dr Félicien Nzotungwanao
Cabo Verde	Ms Maria Conceição Ramos Pinto
Cameroon	Pr Mbanya Dora
Chad	Dr Mbanga Djimadoum
Congo	Dr Mokono Serge Oscar
Côte d'Ivoire	Dr Konate Seidou
Democratic Republic of the Congo	Dr Pacifique Misingi Aye
Eritrea	Dr Yohannes Tekeste
Eswatini	Ms Gugu Maphalala
Ethiopia	Mr Yaregal Bante Demem
Gabon	Dr Olivier Rebienot Pellegrin
Ghana	Dr Justina K. Ansah
Guinea	Dr Haba Nyankoye
Guinea-Bissau	Dr Carlos Da Costa
Kenya	Dr Nduku Kilonzo
Lesotho	Dr Maleqhoa Nyopa
Liberia	Dr Onyekachi C. Subah
Madagascar	Dr Hanitriniala Sahondranirina P.
Malawi	Ms Natasha Nsamala
Mali	Dr Amadou B. Diarra
Mauritania	Dr Khadijetou Ba
Mauritius	Dr Janaki Sonoo
Mozambique	Dr Sara Salimo Guita
Namibia	Mr Israel Chipare
Niger	Dr Zoubeida Mayaki
Nigeria	Dr Omale Joseph Amedu
Sao Tome And Principe	Mr Cristiano Almeida Pires dos Santos
Senegal	Pr Saliou Diop
Seychelles	Ms Joanne Michel Pragassen
South Africa	Dr Karin Van Den Berg
Togo	Pr Feteke Lochina
Uganda	Dr Kyeyune Dorothy
Zambia	Dr Joseph Mulenga
Zimbabwe	Ms Lucy Mary Marowa

ABBREVIATIONS

AfSBT	Africa Society for Blood Transfusion
AIDS	acquired immunodeficiency syndrome
AMU	Arab Maghreb Union
AU	African Union
CUB	Clinical use of blood
DHQ	Donor health questionnaire
DRC	Democratic Republic of the Congo
EAC	East African Community
ECCAS	Economic Community of Central African States
ECOWAS	Economic Community of West African States
EQAS	External quality assessment scheme
FFP	Fresh frozen plasma
FRD	Family replacement donors/donations
IGAD	Intergovernmental Authority on Development
IVIG	Intravenous immunoglobulin
FFP	Fresh frozen plasma
GDBS	Global Database on Blood Safety
LMICs	Low- and middle-income countries
MoH	Ministry of health
MIM	Medicines supply, health Infrastructure and equipment Maintenance Unit
MMR	Maternal mortality rate
NBTS	National blood transfusion service
NGO	nongovernmental organization
OPP	Out-of-pocket payment
PC	Platelet concentrates
PD	Paid donations
PDMP	Plasma-derived medicinal products
QMS	Quality management system
REC	Regional economic communities
RCC	Red cell concentrates
SADC	Southern African Development Community
SDG	Sustainable Development Goal
SSA	Sub-Saharan Africa
SWAP	Step-Wise Accreditation Programme
TTI	Transfusion-transmitted infection

USCDC	United States Centers for Disease Control
VNRBD	Voluntary non-remunerated blood donation
WBDD	World Blood Donor Day
WHA	World Health Assembly
WHO	World Health Organization
WHO AFRO	World Health Organization, Regional Office for Africa

SUMMARY

The WHO Regional Office for Africa has, for two decades, regularly monitored the implementation of the regional strategy and reported the performance indicators on the status of blood availability, safety, and quality in the Region. This survey aims to: (i) provide updated information on critical indicators of availability and access to safe and quality-assured blood products; (ii) measure the level of the implementation of resolutions from the Regional Committee for Africa and the World Health Assembly; (iii) compare the trends with the status reported before the COVID-19 pandemic; and (iv) identify the gaps needing priority attention.

The web-based version of the WHO Global Database for Blood Safety (GDBS) was modified and adapted to the regional context. Then the questionnaire was emailed to NBTS senior staff for data information. The GDBS compiled a set of questions related to administrative information, organization and management, blood donors and blood collection, screening for transfusion-transmissible infections (TTIs), blood components preparation, clinical use of blood and blood components, and plasma-derived medicinal products (PDMP). The 47 countries of the Region were organized within four main groups of regional economic communities (RECs) comprising: (1) the Economic Community of West African States (ECOWAS) and the Arab Maghreb Union (AMU), which includes most of the WHO African Region's West African subregion; (2) the Economic Community of Central African States (ECCAS), that includes almost all the countries of the WHO African Region's Central African subregion; (3) the East African Community (EAC) and the Intergovernmental Authority on Development (IGAD); and (4) the Southern African Development Community (SADC). The EAC, IGAD and SADC include almost all the countries of the East and Southern subregions. Data were entered and analysed in Microsoft Excel 6-0 and Microsoft Word 2010 applications from the Microsoft Office suite.

Out of the 47 invited Member States, 39 agreed to participate in the survey and provided data. The survey included six, five, 13 and 15 countries from ECCAS, EAC/IGAD, SADC and ECOWAS respectively. Global analysis of the data revealed that about two thirds of the countries had developed all the critical blood safety documents in 2020. Thirty-six countries (92.3%) had a blood policy, 33 (84.6%) a strategic plan and 23 (59%) had legislation. Thirty-five countries (89.7%) reported national standards and eight mentioned at least one accredited blood service. Out of the 39 participants, 24 countries (61.5%) received external funding in 2020. More than half of the needed blood units are collected. Out of 39 countries, 16 participants had more than 80% of voluntary non-remunerated blood donation (VNRBD), and 19 had less than 50% of VNRBD. The COVID-19 pandemic impacted blood supply in the Region and hampered progress towards meeting blood needs, mainly during the first 5 months of 2020. The donation rate before and after the COVID-19 pandemic was 4.9/1000 and 5.9/1000 respectively. The proportions of VNRBD and family/replacement donors (FRD) were 71.0% and 27.3% before the pandemic versus 66.5% and 32.7% after the pandemic. The ratio of blood units donated to blood units issued was raised by +0.03 between the two periods. Almost all the blood units were tested for the four main TTIs. About 50/1000 donations were TTI reactive. The overall proportions of TTI-reactive blood units decreased in 2020 compared to 2018 (-0.5%). The overall median proportion of TTI-reactive units was higher in SADC (12.3%) compared to the other RECs. The Region separated 67.6% of the collected whole blood. Sixteen countries separated

more than 90% of the whole blood donations. Compared to 2018, the proportion of separated blood units increased, and six more countries collected fresh frozen plasma (FFP) or platelet concentrates by apheresis at the NBTS or in hospitals. The mean proportions of red cell concentrate (RCC), platelet concentrates and cryoprecipitates were 73.9%, 9.5% and 0.6%, respectively. The blood units were mainly issued to internal medicine wards (32.8%), gynaecology and obstetrics (20%), and paediatrics (14.2%).

Despite the impact of the pandemic on blood supply during the first semester of 2020, the donation rate was higher at the end of 2020 than in 2018. The mitigation measures implemented by countries to overcome reduced activities and gain the confidence of donors in safe blood donation might yield results and support the countries in meeting the WHO recommended donation rate. Despite the resilience demonstrated by the Member States in addressing blood safety issues, significant challenges remain, including the following: unsustainable funding from governments and partner organizations; incomplete document development; persistence of paid donation; low donation rates; low quality screening following inexistent or ineffective quality management systems; weak clinical interfaces often leading to inappropriate clinical transfusion practices; low implementation of haemovigilance systems; and inappropriate information systems. The main recommendation is to enhance technical and financial support and advocacy for low performance countries and improve timely data reporting for adequate decision-making.

1. BACKGROUND

The World Health Organization's (WHO) global report for the year 2019 indicates that sub-Saharan Africa (SSA) has a very high maternal mortality rate (MMR) with a 2017 point estimate of 542 (UI 498 to 649) maternal deaths per 100 000 live births, accounting for approximately 66% of estimated global maternal deaths *(1)*. Despite recent improvements, current analysis confirms that millions of mothers and children are still dying every year because of severe anaemia due to insufficient blood supply. The lack of blood to treat severe perinatal haemorrhage contributes to up to 72% of maternal deaths *(2,3)*. Similarly, delayed transfusion has been associated with increased infant mortality in cases of paediatric malaria-associated anaemia *(4,5)*. Indeed, safe and reliable blood and blood products remain unavailable to many people living in the world's poorest countries, particularly in SSA. While the need for blood is universal, there is a significant imbalance between developing and industrialized countries accessing safe blood. In 2016 WHO's GDBS revealed that less than five units of blood were donated per 1000 population in many African countries, far fewer than the estimated requirements of 10 units/1000 population per year *(6)*.

WHO recognizes that self-sufficient supply of safe blood components based on voluntary, non-remunerated blood donation and the security of that supply are priorities to the populations' health. To address the challenges related to safe and quality-assured blood and blood product availability, the World Health Assembly (WHA)adopted WHA resolution 28.72 in May 1975, urging Member States to take necessary actions to protect and promote the health of blood donors and recipients *(7)*. As stated in resolution AFR/RC44/R12 of 1994, the Regional Committee for Africa also urged the Member States to enact blood safety policies, mobilize resources for blood service infrastructure development at central and district hospitals, and set goals and targets to achieve HIV-free blood transfusion in health-care settings *(8)*. Recalling the latest resolution on HIV/AIDS control, the Regional Committee adopted a strategy for blood safety in 2001 for the African Region, with four key recommendations to Member States: (i) formulate, adopt and implement a national blood transfusion policy consistent with national needs and WHO technical recommendations; (ii) allocate adequate funds for developing the infrastructure of blood transfusion services and creating an enabling environment for the establishment of a reliable blood transfusion system, including the cold chain; (iii) promote voluntary and benevolent blood donation on a regular and permanent basis; and (iv) mobilize bilateral and multilateral partners as well as nongovernmental organizations (NGOs) to provide technical and financial support for the establishment of reliable and sustainable blood transfusion services. In 2015, new global Sustainable Development Goals (SDG) were set with one main goal of ensuring healthy lives and promoting well-being for all ages through several actions. As a critical strategy for achieving health-related SDGs, the availability of safe blood and blood products is expected to contribute to: (i) reducing the global maternal mortality ratio to less than 70 per 100 000 live births; (ii) reducing neonatal mortality to at least as low as 12 per 1000 live births and under-5 mortality to at least as low as 25 per 1000 live births; (iii) ending the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases and combating hepatitis, water-borne diseases and other infectious diseases; and (iv) achieving universal health coverage including financial risk protection, access to quality essential health care services and to safe, effective, quality and affordable essential medicines and vaccines for all *(9)*. In response to the recommendations of these resolutions and calls for action from the Member States, WHO has developed important guidelines, aides-memoires and

other tools to underpin advancements in the safety, effectiveness and quality of blood products, and has provided guidance and technical assistance to countries for building and strengthening their national blood systems. The sixty-seventh session of the Regional Committee for Africa adopted in August 2017 the Framework for health systems development towards universal health coverage in the context of the SDGs in the African Region in which blood and body products are an area identified as needing further investment. This framework, which is specific to blood and body products, proposes to: update and complement norms and standards for blood and body products; develop policy and plan legislation on medical products of human origin (MPHO); establish national regulatory systems for body products; conduct regular data collection surveys on blood and MPHO; develop and update the list of essential body products; establish the production of blood products; scale up capacity for voluntary and donor blood collection in line with needs; procure and distribute blood products in line with needs; align existing capacities of blood transfusion schemes and organ transplant services with need; and reinforce quality management programmes, including improvement of screening strategies for TTIs in blood and organ donations*(10)*. In 2019, a new action framework was defined for the period 2020-2023 to provide strategic direction to regional efforts *(11,12)*.

For two decades, the WHO Regional Office for Africa (WHO AFRO) has regularly monitored the impact of the regional strategy and reported the performance indicators on the status of blood safety and availability in 47 countries. From 2006 to 2018, the average donation rate in the WHO African Region increased from 4.1/1000 to 4.9/1000 population *(13–16)*. Between 2004 and 2018, several international reports noted an overall 0.1–2.2% decline in the average proportion of blood units reactive for transfusion-transmitted infections (TTIs) *(13,17–19)*. The 2018 WHO African Region report concluded that steady progress was made in most countries on the African continent for 20 years despite significant challenges that seriously compromised the availability and access to safe and quality-assured blood for transfused patients.

In 2019, the COVID-19 pandemic hampered the implementation of the regional strategy by adversely affecting health systems and blood transfusion programme activities. WHO AFRO estimated that the COVID-19 pandemic caused a -44% reduction in blood supply in 32 countries out of the 47, and up to 100% reduction in mobile drives in some countries *(20)*. As part of implementing a world contingency mitigation plan, WHO developed and disseminated interim guidance on maintaining safe and adequate blood supply during the COVID-19 pandemic *(21)*. This guidance recommends: (i) mitigating the potential risk of transmission through blood transfusion, staff risk and donor exposure to COVID-19, as well as the risk of reduced availability of blood donors; (ii) managing blood demand; iii) ensuring undisrupted supply of necessary materials and equipment; (iii) communicating to ensure that donors, recipients, all staff, relevant stakeholders and the population are adequately informed; and (iv) collecting convalescent plasma from patients who have recovered from COVID-19. In the wake of the onset of the pandemic in December 2019, the blood supply status has yet to be updated in the Region.

2. AIMS AND OBJECTIVE

This survey aims to: provide updated information on critical indicators of availability and access to safe blood, measure the level of the implementation of resolutions from the Regional Committee for Africa and the World Health Assembly, compare the trends with the status reported before the COVID-19 pandemic and, identify the gaps that need priority attention.

3. METHODS

3.1 Design

This was a multi-centre cross-sectional survey targeting all 47 WHO Africa Region countries based on a self-reporting approach. The Region comprises 17 countries in the West African Subregion, ten countries in the Central Africa Subregion, and 20 countries in the Eastern and Southern Subregion. The 47 countries are organized within regional economic communities (RECs) (Figure 1). The RECs are increasingly involved in coordinating African Union (AU) Member States' interests in wider areas such as peace and security, governance and development, including health development. The AU recognizes eight RECs *(22)*. But for easy analysis and to avoid a small number of countries per group, we organized the WHO AFRO countries into four main RECs:

(a) Economic Community of West African States (ECOWAS) and Arab Maghreb Union (AMU), which includes most of the WHO African Region's West Africa Subregion;

(b) Economic Community of Central African States (ECCAS), which includes almost all the countries of the WHO African Region's Central Subregion;

(c) Southern African Development Community (SADC);

(d) East African Community (EAC) and Intergovernmental Authority on Development (IGAD). EAC, IGAD and SADC include almost all the countries of the Eastern and Southern Subregion of the WHO African Region.

3.2 Data collection tools

The GDBS is a self-administered and structured questionnaire designed to inform on blood safety and availability indicators set by the Regional Committee. It was modified and adapted to the regional context. It mixes open-ended and multiple-choice questions, structured into seven specific domains that are: general information, organization and management, blood donors and blood collection, screening for TTI, blood components preparation, clinical use of blood and blood components, and plasma-derived medicinal products (PDMP). The NBTS were also requested to provide general comments on the progress made by the countries, challenges and the way forward. All the filled questionnaires were checked at the country level and within blood safety programmes at the WHO Regional Office for completeness and accuracy before analysis. Finally, all scanned data were endorsed by the countries.

3.3 Collection method

The adapted regional version of the WHO GDBS questionnaire was emailed to all heads of the national blood services, health care staff responsible for data collection within the NBTS, or to the ministries of health (MoH) through the WHO country offices. Enrolment was based only on their willingness to participate.

3.4 Data analysis

Data were entered and analysed in Microsoft Excel 6-0 and Microsoft Word 2010 applications from the Microsoft Office suite. Data were entered in the analysis spreadsheet for each country and RECs. The following WHO key indicators were calculated for each REC: availability of key policy and technical document, the proportion of VNRBD, the proportion of deferred donors, TTI reactivity rates, the proportion of blood components prepared, the balance of whole blood issued/transfused and the proportion of components discarded. The total population of the WHO African Region was defined by the United Nations Development Programme in 2013 (23). Means, medians, and ranges of key blood safety characteristics were calculated for applicable data and distributed according to the four RECs. The ratio of donated blood/issued blood was calculated by dividing the number of total donations over the number of blood units issued. Finally, we compared the critical data on blood supply before and after the COVID-19 pandemic. All participating countries were adequately informed before they agreed to participate.

3.5 Quality control

Each country validated its data for accuracy and consistency through a final check table. This allowed for the provision of any requisite clarification. Data were double-checked by the WHO expert team and cleaned before they were analysed. Data rendered unavailable, invalid, or for other reasons, unusable were excluded from the analysis. Following the data collection and analysis, the survey outcomes were discussed with the Medicines and Traditional Medicine (MIM) Team Leader, the Technical Officer for Blood Safety (TO/BST) and the key service experts for input and suggestions at WHO AFRO.

3.6 Limitations of the survey

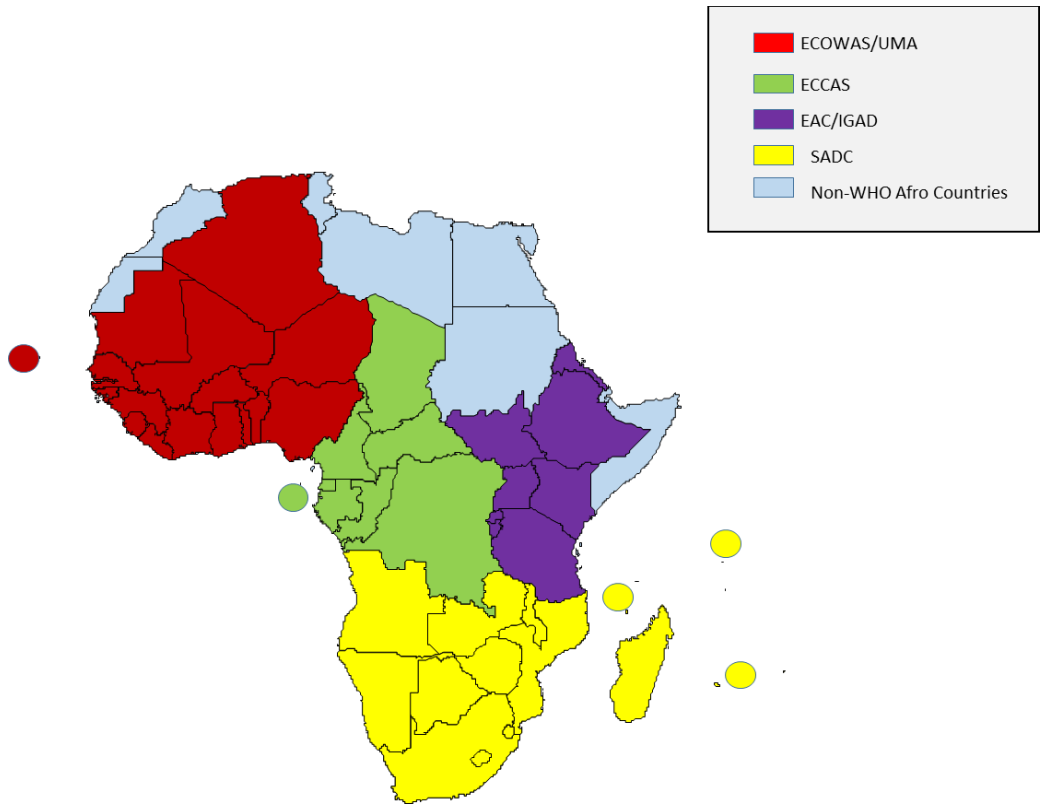
This survey has some limitations. Despite recurrent reminders, several countries did not provide data. Equatorial Guinea did not provide data for the second consecutive survey. Some data were available for a few countries, such as adverse transfusion events and the proportion of transfused units according to age and sex. These data are important for monitoring the effective implementation of patient blood management. They were not analysed since the outcome would not have been representative of the Region. However, with more than 80% of WHO African Region countries included in the survey, all the other critical indicators reflect the current status.

The GDBS is a unique global activity that provides vital data on the safety of blood transfusion services across countries and regions. Improvement in comprehensive and accurate data collection in blood information systems and timeliness of reporting could enhance the GDBS's effectiveness as a global surveillance system for blood safety *(24)*.

4. RESULTS

Thirty-nine countries out of 47 (83%) accepted to participate in the survey and provided data. Despite assiduous follow-up, the following eight countries did not provide information: Central African Republic, Comoros, Equatorial Guinea, Gambia, Rwanda, Sierra Leone, South Sudan, and Tanzania. In 2020, the population of the 39 countries was 819 699 776, representing 89.2% of the WHO Africa Region's population estimated at 918 911 099 *(23)*. The survey included six, five, 13 and 15 countries from ECCAS, EAC/IGAD, SADC and ECOWAS/AMU respectively (Figure 1). The analysis included between 20 and 39 countries for each indicator, depending on data availability.

Figure 1: Countries of the WHO African Region organized within the main regional economic communities



EAC: East African Community
ECCAS: Economic Community of Central African States
ECOWAS: Economic Community of West African States
SADC: Southern African Development Community
AMU: Arab Maghreb Union

4.1 Organization and management

All the 39 participating countries provided data on the organization and management of their blood services. Thirty-six countries (92.3%) had a blood policy and 23 (59%) had legislation. Thirty-five countries (89.7%) reported national standards and eight (20.5%) mentioned at least one accredited blood service.

Out of the 39 participants, 24 countries (61.5%) received external funding in 2020. The Global Fund was active in nine countries, while the United States Centers for Disease Control (USCDC) and WHO provided technical assistance in two and three countries respectively. The SDG Fund supported only Ethiopia in 2020. Nineteen countries out of 39 (48.7%) were funded by their governments, and 24 (61.5%) received funding from external sources (Table 1). Malawi, Mauritius and Namibia were no longer sponsored by their governments and funded their activities through a cost-recovery mechanism.

Table 1. Organization and management of blood services in 39 countries of the WHO African Region in 2020

	ECCAS	EAC/ IGAD	SADC	ECOWAS/ AMU	WHO African Region
Countries (n)	6	5	13	15	39
With blood policies (n)	5	5	11	15	36
With a strategic plan (n)	5	4	10	14	33
With legislation (n)	3	3	8	9	23
With national standards (n)	5	4	12	14	35
Performing EQAS TTIs (n)	2	4	10	7	23
Performing EQAS Blood grouping (n)	1	3	9	4	17
Accredited NBTS (n)	1	3	4	0	8
With national guidelines on CUB (n)	4	4	12	12	32
With national guidelines on haemovigilance system (n)	0	1	6	2	9
Number of stand-alone blood centres (n)	20	35	44	85	184
Number of hospital-based blood centres (n)	339	99	442	591	1,471
Total centres (n)	359	134	486	676	1,655
Funding from government (n)	4	5	8	10	27
Funding from a cost-recovery system (n)	4	1	8	7	20
Funding from external sources (n)	6	4	4	10	24

EQAS: External quality assessment scheme
TTI: Transfusion Transmitted Infection
NBTS: National Blood Transfusion Service
CUB: Clinical use of blood

On the continent, the AfSBT reported that Namibia, Rwanda and Tanzania are the three countries with at least one Africa Society for Blood Transfusion (AfSBT) Step 3 accredited blood service *(25)*. In the ECCAS and ECOWAS RECs, Cameroon was the only country engaged with an external quality assessment scheme (EQAS) for blood group serology and the only one that reported an AfSBT Step 1 accredited centre.

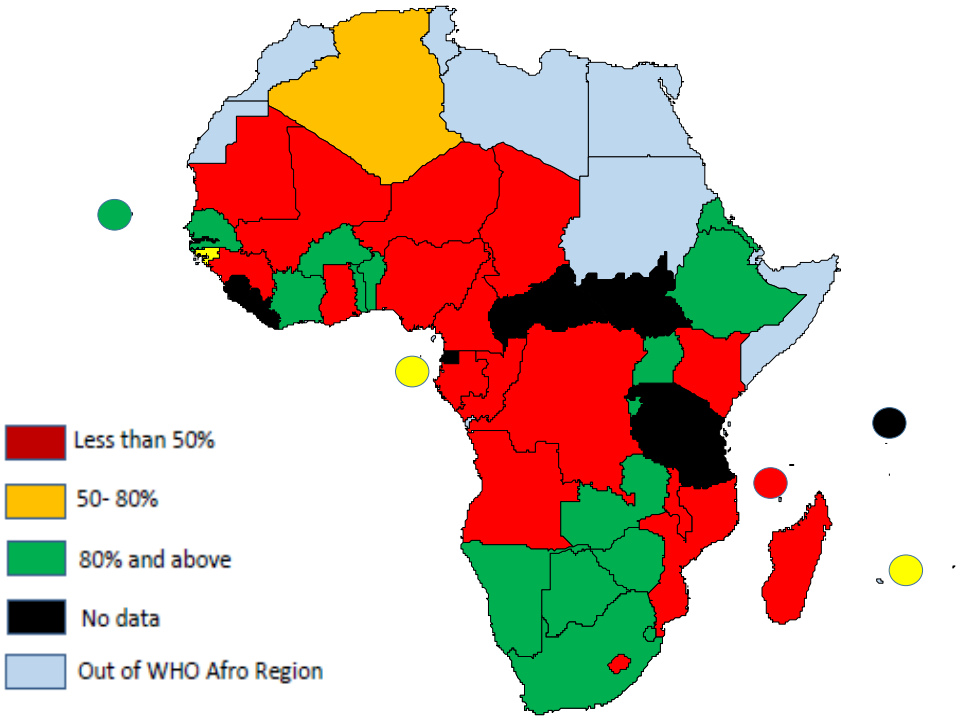
A patient's mean cost to access a blood unit in the Region was US$ 42, ranging from US$ 1.35 in Guinea to US$ 177 in South Africa. Payment of blood units was made directly by out-of-pocket payment (OPP) to the blood service or through a private facility in 14 countries out of 21 and through

an insurance scheme in seven countries out of 21. Eight countries out of 39 did not have information systems. Among the 30 countries with an information system, only 13 had a complete computerized design, and 17 had a manual or partially automated system.

4.2 Blood donors and blood collection

Out of 39 countries, 16 had more than 80% of voluntary non-remunerated blood donation (VNRBD), and 19 had less than 50% of VNRBD (Figure 2).

Figure 2: Proportion of voluntary non-remunerated blood donations in 39 countries of the WHO African Region in 2020



The mean proportion of VNRBD was lower in ECCAS (26.4%) and reached 90.1% in EAC/IGAD. The 38 participants of the WHO African Region collected 4 856 131 blood units, among which 16 539 (0.3%) were apheresis donations. Algeria reported the highest number of blood donations collected by apheresis (12 303 blood units). The average donation rate was 5.9 units per 1000 inhabitants ranging from 1.9/1000 in Madagascar to 34.3/1000 population in Mauritius (Table 2). The paid donations represented 2.8% in the Central African and West African subregions and were reported in Cameroon, Democratic Republic of Congo (DRC) and Nigeria.

Table 2. Characteristics of blood donations in 38 countries of the WHO African Region in 2020					
	ECCAS	EAC/ IGAD	SADC	ECOWAS/AMU	WHO African Region
Inhabitants (n)	156 093 387	217 908 867	211 364 856	229 274 989	814 642 099
Countries (n)	6	5	13	14	38
Countries using apheresis (n)	1	0	5	1	7
Total blood donations (n)	710 090	751 826	1 663 164	1 731 051	4 856 131
Whole blood donations (n)	710 082	751 826	1 658 936	1 718 748	4 839 592
Apheresis donations (n)	8	0	4 228	12 303	16 539
Donation rate (units/1,000 inhabitants)	4.5	3.4	7.8	7.5	5.9
Number (%) of VNRBD	187 495 (26.4)	677 140 (90.1)	1 385 748 (83.3)	969 653 (56.0)	3 220 036 (66.5)
Number (%) of FRD	499 882 (70.4)	68 048 (9.9)	277 589 (16.7)	743 680 (43.0)	1 589 199 (32.7)
Number (%) of PD	22 733 (2.8)	0 (0)	0(0)	17 691 (1.0)	40 424 (0.8)
Number (%) of other types of donors	0	0	0	0	0

VNRBD: Voluntary non-remunerated blood donations
FRD: Family replacement donations
PD: Paid donations

The donation rate before and after the COVID-19 pandemic was 4.9/1000 and 5.9/1000. The proportions of VNRBD and family replacement donations (FRD) were 71.0% and 27.3% before the pandemic versus 66.5% and 32.7% after the pandemic. The ratio of blood units donated/blood units issued was raised by +0.03 between the two periods (Table 3).

Table 3. Differences in blood supply before and after the COVID-19 pandemic			
	Before COVID-19	After COVID-19	Difference between 2018 and 2020
Countries (n)	41	38	NA
Total blood donations reported (n)	4 899 913	4 856 131	NA
Countries with more than 80% of VNRBD (n)	19	16	-3
Donation rate (units/1 000 inhabitants)	4.9	5.9	+1 unit/1 000
Number (%) of VNRBD	3 478 894 (71.0)	3 220 036 (66.5)	- 4.7%
Number (%) of FRD	1 335 566 (27.3)	1 589 199 (32.7)	+5.4%
Number (%) of PD	85 453 (1.7)	40 424 (0.8)	-9%
Mean deferral rate (%)	9.0	8.9	-0.1%
Ratio of blood units donated/blood units issued	0.91	0.94	+0.03

VNRBD: Voluntary non-remunerated blood donations
FRD: Family replacement donations
PD: Paid donations

The average donor deferral rate for the African Region was 8.8%. The main reasons for donor deferral were low haemoglobin levels (2.5%) and other medical conditions (2.3%) (Table 4). Other deferral reasons were underweight, pregnancy status, hypertension, lactation, out-of-accepted age range and current medications.

Table 4. Reason for blood donor deferral in the blood services of 28 countries of the WHO African Region in 2020						
		ECCAS	EAC/ IGAD	SADC	ECOWAS/A MU	WHO African Region
Countries (n)		1	3	14	10	28
Number of donor candidates (n)		83 061	674 631	1 876 948	1 066 814	3 701 454
Number of deferrals(n)		7 950	24 764	231 312	67 767	331 793
Reasons for deferral	Low weight (%)	0.2	0.1	0.4	0.3	0.5
	Low haemoglobin (%)	0.2	0.1	2.1	1.0	2.5
	Other medical conditions (%)	4.5	0.1	2.8	2.1	2.5
	High-risk behaviour (%)	0.1	0.9	3.3	0.1	0.8
	Travel (%)	0	0.3	1.2	0.1	0.3
	Other reasons* (%)	4.5	2.1	2.5	2.0	2.3
	Total deferral (%)	9.5	3.6	12.3	5.6	8.8

Twenty-five countries out of 39 celebrated World Blood Donor Day (WBDD) in 2020. The activities included an official launch by the Ministry of Health (MoH), distribution of medals and certificates to blood donors, education, motivation and recruitment campaigns. The campaign was cancelled in Gabon and held virtually in Zimbabwe because of restrictions due to the COVID-19 pandemic.

4.3 Screening for transfusion-transmissible infections

Overall, 35 participating countries tested 4 313 977 units. All the countries screened 100% of their blood donations for the four TTIs except Chad, where 99.8% and 99.9% of blood donations were tested for HBV and HCV (Table 5). The overall median proportion of TTI reactive units was higher in SADC (12.3%) compared to the other RECs (Table 4). The median proportion of HBV reactive units was 2.8%, ranging from 0.05% in Seychelles to 8.6% in Chad. The proportion of HIV reactive units was highest in Mozambique (2.3%) and lowest in Cabo Verde (0.03%). Madagascar and Sao Tome and Principe reported that all their samples (100%) were tested for malaria. In total, 0.1% (74/52 341) and 0.1% (1/1029) of collected blood units were reactive to Malaria in Madagascar and Sao Tome and Principe.

Table 5. Mean proportion of TTI reactive blood units in the blood services of 35 countries of the WHO African Region in 2020					
	ECCAS	EAC/ IGAD	SADC	ECOWAS/ AMU	WHO African Region
Countries (n)	4	5	13	13	35
Overall tested units (n)	188 813	751 826	1 658 936	1 714 402	4 313 977
Average proportion of HIV tested units (%)	100	100	100	100	100
Average proportion of HBV tested units (%)	99.9*	100	100	100	99.9
Average proportion of HCV tested units (%)	99.9*	100	100	100	99.9
Average proportion of syphilis tested units (%)	99.9*	100	100	100	99.9
Median proportion of HIV reactive (% [range])	1.0 [0.5-2.1]	0.8 [0.4-0.9]	1.0 [0.1-2.3]	1.2 [0.03-2.1]	0.9 [0.03-2.3]
Median proportion of HBV reactive (% [range])	4.1 [3.2-8.6]	1.9 [1.0.2.8]	1.5 [0.05-5.9]	6.2 [0.2-7.0]	2.8 [0.05-8.6]
Median proportion of HCV reactive (% [range])	1.5 [0.0-2.4]	1.8 [0.3-3.5]	0.6 [0.4-2.6]	1.5 [0.0-3.9]	0.6 [0.0-3.9]
Median proportion of syphilis reactive (% [range])	1.2 [0.2-3.0]	1.0 [0.5-1.5]	1.2 [0.1-3.4]	0.8 [0.04-6.4]	0.9 [0.04-6.4]

4.4 Blood component preparation

Thirty-three countries out of 39 provided data on component preparation. The WHO African Region separated 67.6% of the collected whole blood and prepared 3 533 494 blood units. Sixteen countries separated more than 90% of the whole blood donations. The mean proportions of red cell concentrates (RCC), platelet concentrates (PC) and cryoprecipitates were 73.9%, 9.5 and 0.6%, respectively. The highest number of cryoprecipitate were reported by Kenya, South Africa and Zambia. The ECCAS countries did not report any cryoprecipitate prepared in 2020 (Table 6).

Table 6. Patterns of component preparation in the blood services of 33 countries of WHO African Region in 2020					
	ECCAS	EAC/ IGAD	SADC	ECOWAS/AMU	WHO African Region
Countries (n)	3	5	13	12	33
Countries preparing blood components (n)	3	5	13	12	33
Countries preparing red cell concentrates (n)	3	5	13	12	33
Countries preparing platelet concentrates (n)	3	4	13	12	32
Countries preparing fresh frozen plasma (n)	3	5	13	12	33
Countries preparing cryoprecipitate (n)	0	3	4	3	10
Total whole blood donations (n)	95 219	751 826	1 658 936	1 711 982	4 217 963
Total blood components prepared (n)	98 420	351 033	1 770 832	1 652 566	3 533 494
Mean proportion of whole blood separated (%[range])	97.7 [95.9-98]	33.0	70.3 [25.3-100]	74.2 [0.0-100]	67.6 [0.0-100]

		[16.0-93.4]			
Mean proportion of RCC prepared (%[range])	83.7 [79.4-97.4]	82.8 [33.7-100]	68.1 [37.0-100]	79.9 [49.2-97.7]	73.9 [37.5-100]
Mean proportion of PC prepared (%[range])	2.0 [0.2-8.3]	8.5 [0.0-33.1]	11.1 [0.0-33.1]	2.3 [0.0-21.1]	9.5 [0.0-38.8]
Mean proportion of FFP prepared (%[range])	12.3 [0.7-16.1]	12.5 [8.7-100]	20.3 [0.0-52.2]	12.0 [1.4-49.2]	17.6 [0.0-49.3]
Mean proportion of cryoprecipitate prepared (%[range])	0.0	0.0 [0.0-6.2]	1.3 [0.0-6.2]	0.0 [0.0-2.1]	0.6 [0.0-6.2]

RCC: Red cell concentrate
PC: Platelet concentrate
FFP: Fresh frozen plasma

The African Region discarded 344 724 units representing 10.3% of the total donations. The main reasons for discarding were TTIs in the blood units (5.8%) and processing problems (1.6%). ECOWAS/AMU discarded 12.5% of the collected units versus 8.0% in ECCAS (Table 7). Burkina-Faso reported additional reasons for discarding, including excess volume, clots and leaks.

Table 7. Reason for discarding blood units in the blood services of 31 countries of the WHO African Region in 2020

		ECCAS	EAC/ IGAD	SADC	ECOWAS/ AMU	WHO African Region
Countries (n)		4	3	13	11	31
Total donations		195 069	383 719	1 602 452	1 155 500	3 336 740
Total number of discarded units (n)		15 755	36 064	148 919	143 986	344 724
Reasons for discarding	Incomplete collection (%)	0.7	1.7	1.6	1.2	1.4
	TTIs (%)	6.8	2.7	2.9	10.0	5.8
	Expiry (%)	0.5	1.1	1.3	0.7	1.0
	Storage problem (%)	0.01	0.1	0.1	0.1	0.1
	Transportation problem (%)	0.0	0.5	0.1	0.0	0.06
	Processing problem (%)	0.0	2.4	2.8	0.4	1.6
	Other reasons (%)	0.0	0.8	0.3	0.1	0.2
	All reasons (%)	8.0	9.3	9.1	12.5	10.1

TTI: Transfusion transmitted infection

4.5 Clinical use of blood and blood components

The blood units were mainly issued to internal medicine wards (32.8%), gynaecology and obstetrics (20%), and paediatrics (14.2%) (Table 8). Other clinical services receiving blood units were haemodialysis and oncology. South Africa reported the highest number of cryoprecipitate distributed and transfused.

Table 8. Proportion of units issued according to the clinical services in 21 countries of the WHO African Region in 2020					
	ECCAS	EAC/ IGAD	SADC	ECOWAS/ AMU	WHO African Region
Countries (n)	4	1	8	8	21
Total units collected (n)	269 584	90 852	1 379 505	1 003 389	2 743 330
Total units issued (n)	160 226	18 036	1 396 837	1 013 488	2 588 587
Units issued in paediatrics (%)	30.0	21.2	9.4	24.5	14.2
Units issued in internal medicine (%)	25.4	21.9	38.8	15.5	32.8
Units issued in gynaecology &and obstetrics (%)	21.6	23.5	18.9	23.0	20.0
Units issued in Surgery (%)	10.4	9.8	14.7	13.5	14.1
Units issued in emergency and resuscitation (%)	10.1	22.4	5.9	13.2	8.5
Units issued in other clinical services* (%)	2.5	1.2	12.3	10.3	10.4

Thirty-one countries of the Region distributed and transfused 3 444 376 blood units, among which 54.7% of RCC and 31.9% of whole blood. ECCAS distributed and transfused 1.3% of fresh frozen plasma (FFP) versus 10.6 for SADC (Table 9).

Table 9. Proportion transfused in the blood services in 31 countries of the WHO African Region in 2020						
		ECCAS	EAC/ IGAD	SADC	ECOWAS/AMU	WHO African Region
Countries (n)		5	4	12	10	31
Total blood donation (n)		288 663	470 066	1 694 738	959 104	3 412 571
Total units transfused (n)		264 532	440 311	1 713 489	1 026 044	3 444 376
Products distributed and transfused	Whole blood (%)	67.6	54.3	6.2	48.4	31.9
	Red cell concentrates (%)	30.0	42.1	72.5	44.6	54.7
	Platelet concentrates (%)	1.1	1.9	7.8	1.9	4.8
	Fresh frozen plasma (%)	1.3	1.6	10.6	5.0	7.5
	Cryoprecipitates (%)	0.0	0.1	2.9	0.1	1.1
	Leuco depleted RCC (%)	0.0	0.0	0.0	0.0	0.0

Eleven countries provided data on the number of transfusions according to age and sex. The patients aged 15 to 44 years received 42.4 % of the total number of transfusions and 61.1% of transfusions were administered to the women (Table 10).

Table 10. Proportion of units transfused according to age and sex in 11 countries of the WHO African Region in 2020						
		ECCAS	EAC/ IGAD	SADC	ECOWAS/AMU	WHO African Region
Countries (n)		1	1	4	5	11
Total units transfused (n)		138 062	1 110	363 280	330 147	832 599
Number (%) of patients transfused according to sex	Male	55 225 (40.0)	549 (49.4)	126 469 (34.8)	142 027 (43.0)	324 270 (38.9)
	Female	82 837 (60.0)	561 (50.6)	236 811 (65.2)	188 120 (57.0)	508 329 (61.1)
Number (%) of patients transfused according to age	under 5 years	12 426 (9.1)	93 (8.4)	42 740 (11.8)	83 888 (25.4)	139 147 (16.7)
	5 to 14 years	13 806 (9.9)	82 (7.4)	13 613 (3.7)	41 903 (12.7)	69 404 (8.3)
	15 to 44 years	74 553 (54.4)	508 (45.8)	151 912 (41.8)	125 768 (38.1)	352 741 (42.4)
	45 to 59 years	26 232 (18.6)	220 (19.8)	51 519 (4.2)	55 553 (16.8)	133 524 (16.0)
	60 years and older	11 045 (8.0)	207 (18.6)	103 496 (28.5)	23 035 (7.0)	137 783 (16.6)

Only five countries reported data on adverse events. Among 546 544 blood units transfused, 588 (0.1%) adverse events were reported. Post-transfusion purpura (141/588) and transfusion-related acute lung injury (102/588) were the most frequent adverse events.

4.6 Supply of plasma-derived medicinal products (PDMP)

A total of 21 countries out of 30 (70%) reported using albumin and intravenous immunoglobulin (IVIG) and cited PDMP in their list of essential medicines. Out of 30 countries, factor concentrates were used in 19 countries (63.3%) (Table 11). Immunoglobulin-based products appear in the list of PDMP in Senegal, South Africa and Togo.

Table 11. Number of countries with PDMP listed on their essential medicines list in 30 WHO African Region countries in 2020					
	ECCAS	EAC/ IGAD	SADC	ECOWAS/AMU	WHO African Region
Countries (n)	3	2	13	12	30
Albumin (n)	2	1	9	9	21
Intravenous immunoglobulin (IVIG) (n)	2	1	8	9	20
Factor VIII (n)	1	1	9	8	19
Factor IX (n)	1	1	9	8	19
Other (n)	0	0	0	0	0

PDMP: Plasma-derived medicinal products

5. DISCUSSIONS

Global analysis of the current survey data revealed that about two thirds of the countries had developed all the critical blood safety documents in 2020. More than half of the needed blood units are collected, and the TTI reactive blood units count for about 50/1000 donations. The SADC has the best blood safety and availability indicators compared to the other RECs.

5.1 Organization and management

There is consistent involvement of the blood services in developing critical documentation for an appropriate blood service organization. The developed documents might be at a good quality level as in most countries they are produced in a process that includes WHO collaboration or other technical adviser collaboration at the country or regional level. The number of countries having a policy document, legislation, national standards and guidelines for the clinical use of blood is increasing year after year. Legislation was reported in 19 countries in 2013, 20 in 2018 and 23 in 2020, confirming a progressive implementation of the WHO Regional Strategy on regulating blood and blood products *(26)*. Indeed, establishing an appropriate regulatory system can promote and enhance their quality, safety and availability. Regulation allows for the categorization of risk to a proper level of control and the capacity to respond quickly to rapid technological advances while providing the required authority and power to take immediate action during crises and emergencies. Following the adoption of the blood safety legislation, the Member States shall not slow down the process as reported in some countries *(27)* but rather initiate the creation of national regulatory agencies in charge of implementing the adopted law.

The number of accredited facilities has increased from four in 2013 to five in 2018 and to eight in 2020. All the new accredited facilities got their recognition from the Africa Society for Blood Transfusion (AfSBT) Step-Wise Accreditation Programme (SWAP). For the last 20 years, the AfSBT SWAP has successfully conducted several baseline, progress, and formal assessments in more than 15 African countries *(25,28)*. The accreditation of a blood service recognizes that the facility can provide quality products and services to its clients. On the continent, Namibia, Rwanda and Tanzania have at least one centre accredited at the highest step of the AfSBT SWAP, even though Rwanda did not participate in the 2020 survey. This performance could not be achieved without strong support from the governments for the blood transfusion system.

Governments should invest more in blood transfusion services to foster appropriately structured, well-coordinated, and sustainably resourced national blood systems. The low investment in blood services has increased the dependence on external support and raised serious concerns about the sustainability of the funding *(29)*. The level of financial dependence on government support varies from country to country between 30% and 100%. Less dependence provides higher autonomy but is more expensive to the population. The analysis of the list of external funders reveals that the USCDC, the Association for the Advancement of Blood & Biotherapies and the Safe Blood for Africa Foundation supported only two countries in 2020 versus 19 in 2013. The percentage of the USCDC budget allocated to blood safety decreased from approximately 4.5% in 2005 to less than 1% in 2014, highlighting the need for operational planning to buffer a continuing downtrend. External funding has fostered

expanded infectious testing, the establishment of nationalized transfusion services and increased blood donation. But the withdrawal of external aid has imposed new obstacles, with a growing need for operational sustainability in the absence of external support. Developing and implementing cost-effective funding mechanisms will demonstrate government willingness. Malawi, Mauritius and Namibia are no longer sponsored by their governments and are funded by a cost-recovery mechanism. Partial cost recovery has demonstrated current efficacy in Mauritius, where the recovery procedure applies exclusively to private institutions *(30)*.

5.2 Blood donors and blood collection

Considering the WHO standard of collecting at least 10 units per 1000 population as the amount of blood required for blood transfusion needs per country per year, there was a shortfall of 3 290 289 blood units in 2020 in 38 countries. Various observations have highlighted the most frequent reasons for low blood availability. Low donor availability and supply are mainly due to a weak donor recruitment programme, cultural resistance and lack of education affecting the willingness to donate *(31,32)*. In Lesotho, the first reason for the reduction of the VNRBD between 2018 and 2020 is a shortage of staff and funding for donation campaigns following the end of the CDC/PEPFAR project. Indeed, the reduction of the number of blood donor recruiters, counsellors, and nurses might significantly impact the performance of blood services. Moreover, the Ministry of Education in this country no longer allows blood donor recruitment and collection at secondary schools where a significant number of blood units were usually collected. In several countries, family replacement donations and paid donations are still predominant mainly in remote areas where the resistance of cultural beliefs to blood donation is stronger. Absence of nationally coordinated blood services, inappropriate communication strategies, financial constraints, high donor deferral rates *(19,33)*, inappropriate clinical use of blood leading to overconsumption *(4,34)*, loss of blood products through a high proportion of discarded blood units and inappropriate patient blood management may also contribute indirectly to the low availability of blood. The conjunction of efficient blood supply actions may significantly increase blood availability in clinical services. The reduction of unnecessary donor deferral can increase by 5% the number of blood units collected and can be obtained through an appropriate donor health questionnaire designed and evaluated using local TTI risk factors *(35,36)*.

When comparing the period before and after the COVID-19 pandemic, the proportion of VNRBD decreased by 5%. Only 16 countries reported more than 80% of VNRBD compared to 19 countries before the pandemic. Some countries such as Kenya, Lesotho, Malawi and Mauritius reported a significant drop in the proportion of VNRBD from more than 80% to less than 50% (*19*). COVID-19 impacted blood supply in the Region and hampered progress towards meeting blood needs, mainly during the first 5 months of 2020. Indeed, the number of blood donations in that period dropped by up to 44% in 30 countries, compared to the same period in 2019 *(20)*. Lockdown orders, donor anxiety and fear of COVID-19 infection during blood donation, which often stems from popular misconceptions and misinformation, have hindered blood donors in the countries with reduced blood donations from accessing blood transfusion services. Since the donors lack confidence in blood services to protect them against the disease, education should focus on wrong conceptions about the disease and its transmission routes, insisting that the transmission of SARS-Cov-2 through blood transfusion is only theoretical. In Malawi during the pandemic schools were closed for a prolonged period of time

and no drives were organized during Christmas and New Year festivities as in previous years. Mauritius reported that the decrease in the number of voluntary blood donors was mainly attributed to the COVID-19 pandemic.

Despite the impact of the pandemic on blood supply in the first semester of 2020, the donation rate per 1000 inhabitants was higher at the end of 2020 than in 2018; this is the result of an increase in the proportion of FRD (+5.4%) and the decrease in blood units issued *(19,20)*. The urgent needs during the crisis are compensated by family replacement donations and paid donations that are usually disguised as non-remunerated family support. The mitigation measures implemented by countries to overcome the reduced activities and gain the confidence of donors in safe blood donation might yield results and support the countries in meeting the WHO recommended donation rate. Indeed, countries implemented measures such as public awareness campaigns, transporting donors to and from their homes with authorization from relevant national authorities, providing facemasks, hand washing equipment and sanitizers, and modifying donor screening procedures to adapt to the risk of exposure to COVID-19. According to the Mauritius blood service, the number of blood donations is increasing following additional mitigation measures such as mandatory sanitary protocols at donation sites, temperature records, physical distancing, wearing of masks, use of hand sanitizers and swabbing of the couch with disinfectant after each donation.

Since the African population is relatively young, it can provide a potentially important source of blood donors if NBTSs can build on this advantage, provide adequate education and develop appropriate and sustainable motivation and collection programmes based on VNRBD. In particular, as shown in several countries, education is essential to convince family replacement donors, initially committed to helping their close community, to convert into altruistic repeat VNRBD. The participation of all the stakeholders involved in population mobilization and education is essential, notably the commitment of social leaders, political authorities and civil society.

5.3 Screening for transfusion-transmissible infections

The current survey revealed that 100% of the blood units collected in African countries were screened for the four markers, except in Chad where 99.9% of samples were tested. For the first time, the WHO recommendation urging Member States to screen all their blood units before transfusion has almost been complied with at 100% as part of the effective implementation of a national screening programme for transfusion-transmissible infections. The screening performance of the main TTIs shall be the next critical issue to address since quality screening is as important as blood unit testing itself. With a high TTI residual risk of up to 1/200 in several African blood services *(37,38)*, very few blood services have adopted a full implementation of a quality management system (QMS). A few of them have appointed a quality manager, referred to recognized standards or performed regular external quality assessments. The governments shall focus more on strategies to improve the quality of the screening processes for safer blood units. Serological and molecular TTI screening requires prequalified and verified assays, a sufficient number of qualified, trained and competent staff, and regular quality controls *(39–41)*. There is a need to implement a minimum QMS, at least one that does not need significant financial investment.

The overall proportions of TTI reactive blood units decreased in 2020 compared to 2018 (-0.5%). The US CDC and the Francophone Africa Transfusion Research Network also reported a continuous decline in TTI seroprevalence by 0.1–2.2% since 2004 *(13,17–19)*. This is consistent with the increase in the proportion of VNRBD and might be associated with progressive implementation of good practices in donor deferral, such as the use of donor-health questionnaires (DHQ). Blood donor screening effectively reduces TTIs associated with appropriate DHQ and procedures. The further development of tailored DHQ with local risk factors might reduce the prevalence of TTIs in blood donation and improve the safety of blood components.

Hepatitis B remains the deepest TTI concern. The median proportion of blood units reactive to HBV represents up to 70% of contaminated blood units, especially in the ECCAS and ECOWAS/AMU. Immunization programmes against Hepatitis B in blood donors might reduce by half the transfusion-transmitted hepatitis B. Still, the cost of such a programme shall be included in a sustainable funding approach for the blood services *(15,42)*.

Given that the majority of blood recipients in low- and middle-income countries (LMICs) are children and pregnant women and only a few parasites in a unit of blood are enough to cause infection in exposed individuals, WHO recommends that donor selection criteria should be developed to collect blood from donors at the lowest risk of malaria or that malaria shall be screened in blood donors. Each blood service should choose the most adapted strategy tailored to its local epidemiological data *(43)*. Surprisingly, the two countries in the current survey that screen their blood units for malaria reported only 1/1000 blood units contaminated with malaria parasites. More data should be collected to confirm the current trends in the WHO African Region before updating recommendations.

5.4 Blood component preparation

With the development of modern clinical services demanding regular supply with FFP, PC and cryoprecipitate, 16 countries separate more than 90% of their whole blood donations. Compared to 2018, the proportion of separated blood units increased and six more countries collected FFP or PC by apheresis at the NBTS or in hospitals. The advantage of preparing components is that many patients can benefit from a single donation. Separating whole blood into components may also reduce the degradation of platelets and labile clotting factors under whole blood storage conditions *(44)*. Finally, the modern concept of blood transfusion is to transfuse only the required component to patients and prevent additional transfusion adverse events. Much of the separated plasma in the Region is not of suitable quantity and quality to undergo fractionation *(6,45)*. Where resources are scarce, the additional cost of component preparation may make transfusions unaffordable and unsustainable for transfusion services to maintain without external donor funding. An economic study in Zimbabwe showed that a unit of packed red cells costs higher than a unit of whole blood. The cost includes the production cost and the incineration cost of deteriorated components and unused FFP *(46)*. The component production rate should consider the demand and scale up production with resources.

Only cryoprecipitate is prepared from FFP in a few countries. Cryoprecipitate is required to treat acquired fibrinogen deficiency or dysfibrinogenaemia due to critical bleeding, an invasive procedure, trauma, or disseminated intravascular coagulation. Without imported freeze-dried factor VIII, most

haemophilic patients remain untreated or treated with fresh frozen plasma at best *(47)*. By producing single-donor cryoprecipitate, treatment with a much smaller volume yet more concentrated product might become a reality. Although preparation of cryoprecipitate is relatively easy, trained and competent staff are critical, as well as a sterile production procedure.

5.5 Clinical use of blood and blood components

Two thirds of the blood issued is transfused to patients in internal medicine, gynaecology and paediatric wards. Half of the patients transfused are females aged 15–44 years. Severe anaemia in women following post-partum haemorrhage represents up to 70% of the total blood transfusion indications in several African countries *(48–50)*. This explains why RCC and red cell-containing products, including whole blood, are the most transfused. With the low need-to-supply rate in the Region, WHO decided to put whole blood and blood components on the WHO list of essential medicine. Indeed, achieving self-sufficiency in the supply of safe blood components is an important national goal to prevent blood shortages and meet the transfusion requirements of the patient population *(51)*. Several studies also support the benefit of whole blood in some circumstances, such as resuscitation of severe traumatic haemorrhage *(43,52,53)*. But some African countries are not recommending its use in their guidelines for safety reasons. Whole blood contains more plasma, leucocyte, citrate, hydrogen, potassium and ammonia than packed red cells, which may increase the risk of specific side effects, including transfusion-associated circulatory overload *(50)*. To prevent adverse events, clinicians should avoid unnecessary blood transfusion and overconsumption through recommended patient blood management and blood transfusion alternatives.

5.6 Supply of plasma-derived medicinal products

Fractionation of plasma generates a range of purified, virally inactivated protein therapeutics that reduce some adverse effects (fevers, chills, transfusion-transmitted infections and volume overload) while providing better treatment for people suffering from acquired fibrinogen deficiency, haemophilia, von Willebrand disease or immunodeficiency. With 18% of the world's population, Africa represents less than 3% of patients identified with haemophilia and only 2% use PDMP for treatment *(47)*. Almost none of the plasma produced in the Region is processed into products since there is currently only one plasma fractionation facility located in South Africa. Several international initiatives have led a commendable effort to raise awareness on the public health issue related to congenital bleeding diseases and raise a concern about the growing need for PDMP in Africa *(54)*. But in 2020, only South Africa reported a fractionation of plasma activity collected in the country. Challenges to the preparation of PDMP include the lack of a structured blood collection system, qualified health workers and storage infrastructure. Only Namibia, Rwanda and South Africa seem to fulfil the local plasma fractionation regulation or requirements by the fractionator (individual donor-nucleic acid testing screening and level three Step-Wise AfSBT accreditation) *(55)*. Although 21 countries participating in this survey have some access to PDMP, sustainable provision is not guaranteed given that the products are costly. The countries should follow the recent WHO Guidance on increasing supplies of plasma-derived medicinal products in LMICs through the fractionation of domestic plasma *(56)*. WHO recommends a Step-Wise approach towards improving access to PDMPs through local

production of safe plasma products while waiting for an adequate environment for plasma fractionation.

5.7 General comments from the NBTS

Despite the negative impact of COVID-19 on blood donations in 2020, the countries' participants self-reported some progress in developing blood transfusion programmes, improvement in infrastructure development, expansion of the NBTS, financial autonomy, communication and quality management systems. Their main recommendations were to train staff working in the NBTS in addition to clinicians and nurses; implement antibody screening and identification; implement the quality management system and accreditation programme; provide financial support to NBTS for equipment renewal, reagents and consumable supplies; enhance the performance of national quality and haemovigilance systems; and develop a computerized information system.

6. CONCLUSIONS

Despite the lack of some countries' data, a high rate of response to the GDBS questions in this survey provided a comprehensive status of blood safety and availability in the WHO African Region. About half of the needed blood units are still needed, according to the WHO recommended donation rate and TTI-reactive blood units account for about 50/1000 donations. The ECCAS and EAC have the poorest blood safety and availability indicators. The COVID-19 pandemic hampered blood collection and distribution in 2020. However, the coordinated implementation of special mitigation measures limited the pandemic's impact on blood supply. Only the proportion of VNRBD decreased. Progress in the other indicators were unexpected during the pandemic but countries demonstrated significant resilience. Some progress was made in terms of organization and management, transfusion-transmitted infections and component preparation. More countries are engaged in quality management systems and Step-Wise accreditation programmes for their blood services. These outcomes support that governments' commitment to implementing the WHO regional strategy can produce effective resilience to crises. However, the global challenge of a sustainably funded and regulated blood service remains, as well as the provision of enough safe blood for the entire population.

7. RECOMMENDATIONS

7.1 To the Member States

(a) Governments should invest more in blood transfusion services for appropriately structured, well-coordinated and sustainably resourced national blood systems. Thus, advocacy shall be increased with national governments and funding agencies for the allocation of more resources to national blood transfusion services, especially those with the poorest WHO indicators.

(b) Governments should implement WHO-recommended strategies to increase voluntary blood donations and reduce the risk of TTIs in blood and blood components.

(c) The countries should develop preparedness and contingency plans to be implemented in crises affecting the level of blood supply. Collaboration on epidemiological surveillance of pandemics should be developed with departments in charge of emergency management.

(d) Ministries of health should also dedicate sufficient funds to cover the cost of safe transfusion, making it more affordable and tailor-made to reduce dependency on external funding. Partnerships, collaboration and information sharing should be explored to achieve key priorities and jointly address challenges and emerging threats. Finally, the evolution of the blood transfusion system in SSA should align with international resolutions, as summarized in recent WHO guidelines and WHA resolutions.

(e) Blood services should work closely and in coordinated with all the stakeholders involved in blood availability, given that the conjunction of efficient blood supply actions may significantly increase blood availability in clinical units.

(f) Governments should step forward to establish effective regulatory systems through national regulatory agencies and optimize the quality of blood and blood products through adequate quality and haemovigilance systems.

(g) Clinicians should be trained in the clinical use of blood to avoid unnecessary blood transfusion and overconsumption through recommended patient blood management and blood transfusion alternatives.

7.2 To WHO and partners

(a) Higher support to Member States for the implementation of the WHO regional strategy is needed to close the gaps within set timeframes. A cause analysis should be conducted in the four countries where the drop in VNRBD is highest.

(b) Data collection and adherence to quality data reporting for monitoring and evaluation of progress are essential. WHO and its partners should support the Member States to adopt and implement appropriate systems and technologies for real-time data collection. Such a programme should be developed progressively, starting with a pilot number of countries. The current development of national regulatory agencies and QMS in countries may serve as a reference tool for an effective and coordinated information system.

8. REFERENCES

1. World Health Organization. Trends in maternal mortality 2000 to 2017: estimates by WHO, UNICEF, UNFPA, World Bank Group, and the United Nations Population Division. 2019.
2. Bates I, Chapotera GK, McKew S, van den Broek N. Maternal mortality in sub-Saharan Africa: the contribution of ineffective blood transfusion services. BJOG Int J Obstet Gynaecol. October 2008;115(11):1331-9.
3. Musarandega R, Nyakura M, Machekano R, Pattinson R, Munjanja SP. Causes of maternal mortality in sub-Saharan Africa: A systematic review of studies published from 2015 to 2020. J Glob Health. 2021;11:04048.
4. Maitland K, Olupot-Olupot P, Walker AS. Transfusion timing and volume in African children with severe anaemia. Reply. N Engl J Med. 24 October 2019;381(17):1687-8.
5. Stevens GA, Finucane MM, De-Regil LM, Paciorek CJ, Flaxman SR, Branca F, et al. Global, regional, and national trends in haemoglobin concentration and prevalence of total and severe anaemia in children and pregnant and non-pregnant women for 1995-2011: a systematic analysis of population-representative data. Lancet Glob Health. July 2013;1(1):e16-25.
6. World Health Organization. Global status report on blood safety and availability 2016. WHO, Geneva, Switzerland; 2017.
7. World Health Organization. Utilization and supply of human blood and blood products. In: 28th World Health Assembly 1975. [Resolution WHA28.72]. WHO, Geneva, Switzerland; 1975. (https://www.who.int/bloodsafety/en/WHA28.72.pdf (accessed 11 March 2022)
8. World Health Organization. AIDS control: current status of AIDS control activities in the African Region. In: 44th Regional Committee for Africa.1994 [Resolution AFR/RC44/R12]. WHO Regional Office for Africa, Brazzaville, Gongo; 1994; (https://apps.who.int/iris/bitstream/handle/10665/99667/AFR RC44 R12 eng.pdf?sequence=1, (accessed 18 April 2022)
9. United Nations. Transforming our World: The 2030 Agenda for Sustainable Development (A/RES/70/1). 2015 ; (https://sustainabledevelopment.un.org/content/documents/21252030%20Agenda%20for%20Sustainable%20Development%20web.pdf, accessed 18 April 2022)
10. World Health Organization. Regional Committee for Africa, 67. (2017). Framework for health systems development towards universal health coverage in the context of the sustainable development goals in the African Region: report of the Secretariat. WHO Regional Office for Africa, Brazzaville, Gongo; 2017; (https://apps.who.int/iris/handle/10665/260237, accessed 18 April 2022
11. Loua A, Nikiema JB. Cadre d'action pour la promotion de l'accès universel à des produits sanguins sûrs dans la Région africaine de l'OMS in Livre des résumés - XXXe Congrès de la Société Française de Transfusion Sanguine (SFTS) - Marseille, 24-26 November 2021. Transfusion Clinique Et Biologique: Journal De La Societe Francaise De Transfusion Sanguine. 28e éd. 2021;S1-140.
12. World Health Organization. Action framework to advance universal access to safe, effective, and quality-assured blood products 2020–2023. 2020.

13. World Health Organization. Status of Blood safety in the WHO African Region: Report of the 2006 Survey. WHO AFRO, Brazzaville, Gongo; 2009.

14. World Health Organization. Status of Blood safety in the WHO African Region: Report of the 2010 survey. WHO AFRO, Brazzaville, Gongo; 2014.

15. World Health Organization. Current status on blood safety and availability in the WHO African region: Report of 2013 survey. WHO Regional Office for Africa, Brazzaville, Gongo; 2016.

16. Loua A, Nikiema JB, Kasilo OJM, Tagny CT. Blood safety and availability in the WHO African region. Global Surgery. Volume 4(3). 2018;1-7.

17. Centers for Disease Control and Prevention (CDC). Progress toward strengthening blood transfusion services--14 countries, 2003-2007. MMWR Morb Mortal Wkly Rep. 28 November 2008;57(47):1273-7.

18. Tagny CT, Laperche S, Murphy EL, Francophone Africa Network for Transfusion Medicine Research. Updated characteristics of blood services, donors, and blood products in 11 French-speaking African countries. Vox Sang. 19 August 2018.

19. Loua A, Nikiema JB, Sougou A, Kasilo OJM. Transfusion in the WHO African Region. Transfus Clin Biol J Soc Francaise Transfus Sang. September 2019;26(3):155-9.

20. Loua A, Kasilo OMJ, Nikiema JB, Sougou AS, Kniazkov S, Annan EA. Impact of the COVID-19 pandemic on blood supply and demand in the WHO African Region. Vox Sang. August 2021;116(7):774-84.

21. World Health Organization. Maintaining a safe and adequate blood supply during the pandemic outbreak of coronavirus disease (COVID-19) Interim guidance 20 March 2020 Some rights reserved; 2020.

22. African Union. Regional Economic Communities (RECs); (https://au.int/en/organs/recs, (accessed 12 April 2022)

23. United Nations Department of Economic and Social Affairs, Population Division. World Population Prospects: The 2017 revision. 2017.

24. Kanagasabai U, Selenic D, Chevalier MS, Drammeh B, Qualls M, Shiraishi RW, et al. Evaluation of the WHO global database on blood safety. Vox Sang. February 2021;116(2):197-206.

25. Tapko JB, Tagny CT. The AfSBT SEPwise accreditation programme: Improving the quality in the African blood services. Transfus Clin Biol J Soc Francaise Transfus Sang. May 2021;28(2):146-7.

26. World Health Organization. Regional strategy on the regulation of medical products in the African region, 2016-2025. In: 66thRegional Commit-tee for Africa. Addis Ababa, Ethiopia; 2016 [Resolution AFR/RC66/R2] . WHO Regional Office for Africa, Brazzaville, Gongo; 2016. (https://www.afro.who.int/sites/default/files/sessions/resolutions/afr-rc66-r2-en-2109.pdf.; (accessed 19 April 2022)

27. Ansah JK, Kafere C, Loua A, Nkansah E, Acquah ME, Mudyiwenyama L. Regulation of blood services in Africa. Transfus Clin Biol J Soc Francaise Transfus Sang. May 2021;28(2):148-53.

28. Kanagasabai U, Qualls M, Shiraishi RW, Eno L, Zungu I, Bust L, et al. Baseline assessment findings of the Africa Society for Blood Transfusion Step-Wise accreditation programme in 10 sub-Saharan African countries, 2016-2018. Vox Sang. 10 March 2022;

29. van Hulst M, Smit Sibinga CT, Postma MJ. Health economics of blood transfusion safety--focus on sub-Saharan Africa. Biol J Int Assoc Biol Stand. January 2010;38(1):53-8.

30. Loua A, Sonoo J, Musango L, Nikiema JB, Lapnet-Moustapha T. Blood Safety Status in WHO African Region Countries: Lessons Learnt from Mauritius. J Blood Transfus. 2017;2017:1970479.

31. Asamoah-Akuoko L, Hassall OW, Bates I, Ullum H. Blood donors' perceptions, motivators and deterrents in sub-Saharan Africa - a scoping review of evidence. Br J Haematol. 2017;177(6):864-77.

32. Appiah B, Burdine JN, Aftab A, Asamoah-Akuoko L, Anum DA, Kretchy IA, et al. Determinants of Intention to Use Mobile Phone Caller Tunes to Promote Voluntary Blood Donation: Cross-Sectional Study. JMIR MHealth UHealth. 4 May 2018;6(5):e117.

33. Tagny CT, Kouao MD, Touré H, Gargouri J, Fazul AS, Ouattara S, et al. Transfusion safety in francophone African countries: an analysis of strategies for the medical selection of blood donors. Transfusion (Paris). January 2012;52(1):134-43.

34. Maitland K, Olupot-Olupot P, Kiguli S, Chagaluka G, Alaroker F, Opoka RO, et al. Transfusion volume for children with severe Anaemia in Africa. N Engl J Med. 1 August 2019;381(5):420-31.

35. Tagny CT, Nguefack-Tsague G, Fopa D, Ashu C, Tante E, Ngo Balogog P, et al. Risk factors for human immunodeficiency virus among blood donors in Cameroon: evidence for the design of an Africa-specific donor history questionnaire. Transfusion (Paris). 2017;57(8):1912-21.

36. Kouegnigan Rerambiah L, Biyoghe AS, Bengone C, Djoba Siawaya JF. Evaluation of blood donors questionnaire in a developing country: The case of Gabon. Transfus Clin Biol J Soc Francaise Transfus Sang. June 2014;21(3):116-9.

37. Lefrère JJ, Dahourouh H, Dokekias AE, Kouao MD, Diarra A, Diop S, et al. Estimate of the residual risk of transfusion-transmitted human immunodeficiency virus infection in sub-Saharan Africa: a multinational collaborative study. Transfusion (Paris). March 2011;51(3):486-92.

38. Guekeng E, Nsagha D, Zofou D, Njunda A, Nanfack A, Fokam J, et al. Residual risk of HIV transmission through blood transfusion in five blood banks in Cameroon. Journal of Medical Research. 2020;158-65.

39. Drammeh B, Laperche S, Hilton JF, Kaidarova Z, Ozeryansky L, De A, et al. Proficiency testing of viral marker screening in African blood centers - Seven African Countries, 2017. MMWR Morb Mortal Wkly Rep. 25 Oct 2019;68(42):947-52.

40. Laperche S, Francophone African Group for Research in Blood Transfusion. Multinational assessment of blood-borne virus testing and transfusion safety on the African continent. Transfusion (Paris). April 2013;53(4):816-26.

41. Bloch EM, Shah A, Kaidarova Z, Laperche S, Lefrere JJ, van Hasselt J, et al. A pilot external quality assurance study of transfusion screening for HIV, HCV, and HBsAg in 12 African countries. Vox Sang. November 2014;107(4):333-42.

42. World Health Organization. PREVENTION, CARE AND TREATMENT OF VIRAL HEPATITIS IN THE AFRICAN REGION: FRAMEWORK FOR ACTION, 2016 - 2020. 2017.

43. World Health Organization. Screening donated blood for transfusion-transmissible infections: recommendations. Geneva, Switzerland; 2010 ;

https://www.who.int/bloodsafety/ScreeningDonatedBloodforTransfusion.pdf, (accessed 14 March 2022)

44. Avery P, Morton S, Tucker H, Green L, Weaver A, Davenport R. Whole blood transfusion versus component therapy in adult trauma patients with acute major haemorrhage. Emerg Med J EMJ. June 2020;37(6):370-8.

45. World Health Organization. Improving Access to Safe Blood Products through Local Production and Technology Transfer in Blood Establishments. Geneva, Switzerland; 2015.

46. Mafirakureva N, Nyoni H, Nkomo SZ, Jacob JS, Chikwereti R, Musekiwa Z, et al. The costs of producing a unit of blood in Zimbabwe. Transfusion (Paris). March 2016;56(3):628-36.

47. World Federation of Haemophilia. WFH-Report on the annual global survey 2017. 2018. (http://www1.wfh.org/publications/files/pdf-1714.pdf; (accessed 19 April 2022).

48. Bloch EM, Hull J, Green-Thompson R, Ingram C, Crookes RL, Fawcus S, et al. Antenatal blood transfusion in South Africa: indications and practice in a high-HIV-prevalence setting. Transfusion (Paris). March 2020;60(3):479-87.

49. Reggiani G, Muhelo A, Cavaliere E, Pizzol D, Frigo AC, Da Dalt L. Emergency pediatric blood transfusion practices in Mozambique. Transfus Med Oxf Engl. December 2020;30(6):505-7.

50. Kohli N, Bhaumik S, Jagadesh S, Sales RK, Bates I. Packed red cells versus whole blood transfusion for severe pediatric anaemia, pregnancy-related anaemia, and obstetric bleeding: an analysis of clinical practice guidelines from sub-Saharan Africa and evidence underpinning recommendations. Trop Med Int Health TM IH. January 2019;24(1):11-22.

51. World Health Organization. The WHO model list of essential medicines - 22nd list WHO/MHP/HPS/EML/2021.02. WHO, Geneva, Switzerland; 2021.

52. Cap AP, Beckett A, Benov A, Borgman M, Chen J, Corley JB, et al. Whole blood transfusion. Mil Med. 1 September 2018;183(suppl_2):44-51.

53. Spinella PC, Cap AP. Whole blood: back to the future. Curr Opin Hematol. November 2016;23(6):536-42.

54. Srivastava A, Santagostino E, Dougall A, Kitchen S, Sutherland M, Pipe SW, et al. WFH Guidelines for the Management of Haemophilia, 3rd edition. Haemoph Off J World Fed Hemoph. August 2020;26 Suppl 6:1-158.

55. Barro L, Drew VJ, Poda GG, Tagny CT, El-Ekiaby M, Owusu-Ofori S, et al. Blood transfusion in sub-Saharan Africa: understanding the missing gap and responding to present and future challenges. Vox Sang. 16 September 2018;

56. World Health Organization. WHO Guidance on increasing supplies of plasma-derived medicinal products in low- and middle-income countries through fractionation of domestic plasma. Geneva, Switzerland; 2021 (https://apps.who.int/iris/handle/10665/340171, (accessed 19 April 2022)