BMC Public Health

RESEARCH

Open Access

Seroprevalence of transfusion transmitted infections among blood donors in Hargeisa, Somaliland: a retrospective study

Ahmed I. Farah[1], Hassan M. Abdi[1,2], Abdifatah J. Mohmed[2], Suad M. Abase[2], Muna M. Ismail[2], Jinaw M. Qalib[1], Asgeir Johannessen[3,4] and Stian M. S. Orlien[1,3,5*]

Abstract

Background Blood transfusions save millions of lives each year, but are also associated with significant health risks, including transfusion-transmitted infections (TTIs). The World Health Organization recommends mandatory screening for human immunodeficiency virus (HIV), hepatitis B virus surface antigen (HBsAg), hepatitis C virus antibody (anti-HCV), and syphilis prior to transfusion. This study presents the first screening results from a public blood bank in Somaliland.

Method Records from blood donors attending the blood bank of Hargeisa Group Hospital, Somaliland from January 2020 throughout December 2022 were reviewed retrospectively. Blood donations were screened using rapid diagnostic tests for HIV, HBsAg, anti-HCV and syphilis. Screening results and baseline demographic data were collected from all unique blood donors.

Results Among the 19,021 blood donors, 18,989 (99.8%) were male and the median age was 29 (interquartile range 25–35) years. A total of 310 (1.6%) individuals had one of the four TTIs screened for, of whom 226 (73%) were HBsAg positive. The seroprevalence of HIV was 0.1%; HBsAg 1.2%; anti-HCV 0.1%; and syphilis 0.3%. No co-infections were found.

Conclusion The most common TTI was hepatitis B virus infection. The reported seroprevalence of TTIs was low compared to other studies in the region.

Keywords HBV, HCV, *Treponema pallidum*, Epidemiology, Somalia

*Correspondence:
Stian M. S. Orlien
stian@orlien.no
[1]College of Medicine and Health Sciences, University of Hargeisa, Hargeisa, Somaliland
[2]Department of Microbiology, Hargeisa Group Hospital, Hargeisa, Somaliland
[3]Department of Infectious Diseases, Vestfold Hospital Trust, Tønsberg, Norway
[4]Sustainable Health Unit (SUSTAINIT), University of Oslo, Oslo, Norway
[5]Department of Paediatrics, Oslo University Hospital, Oslo, Norway

Background

Globally, nearly 120 million units of blood are donated every year and considered as lifesaving supportive care [1]. However, blood transfusions are also associated with significant health risks, including transfusion-transmitted infections (TTIs). The World Health Organization (WHO) recommends that all blood donations should be subject to mandatory screening for human immunodeficiency virus (HIV), hepatitis B virus (HBV), hepatitis C virus (HCV), and syphilis prior to transfusion.

Globally, the seroprevalence of HIV, HBV, HCV and syphilis markers among blood donors vary greatly, with the lowest seroprevalence in high-income countries and the highest seroprevalence in low-income countries. Among blood donors in low and low-middle income countries, the estimated pooled median seroprevalence is nearly 1% for HIV, 4.5% for HBV, 1.4% for HCV, and 1.6% for syphilis [1].

In sub-Saharan Africa, a high prevalence of HIV has been a challenge for more than thirty years. Although the majority of HIV transmission is attributable to unprotected sexual intercourse, it is also transmitted through unsafe blood transfusion. A previous study suggested that 1% of new HIV infections are attributable to blood transfusions in sub-Saharan Africa [2]. However, the data on HIV burden in blood donors and recipients post transfusion are scarce, and thus the incidence of HIV infection attributable to blood transfusion remains uncertain.

Globally, about 300 million people live with chronic HBV infection, of whom an estimated 82 million reside in sub-Saharan Africa [3]. In countries where donor screening and blood testing have been implemented, the estimated risk of acquiring HBV infection after blood transfusion is considered low, around 1:500,000 blood units [4]. However, in low-income countries children under five years of age receive up to 54% of all blood transfusions given, hence children run a higher risk of acquiring chronic HBV infection after blood transfusion than adults [3, 5, 6].

An estimated 58 million individuals are chronically infected with HCV worldwide, of whom 9 million live in the WHO African region [7]. In high-income countries, the estimated risk of acquiring HCV infection after blood transfusion is considered low, less than 1:200,000 blood units. In low-income countries, however, blood transfusion still remains one of the main causes of HCV transmission [3, 7–9].

The global burden of syphilis infection is high, with an estimated 7.1 million incident cases occurring annually [10]. Syphilis transmission has occurred via blood transfusion in the past; however, since the implementation of blood safety programs and refrigeration of blood products, it is now believed to be rare [4, 11, 12].

Data on the prevalence of TTIs at the Horn of Africa are scarce. A recent study of 420 blood donors at the Somali Sudanese Specialized Hospital in Mogadishu, Somalia found a seroprevalence of 0% for HIV and HCV, 2.1% for HBV and 0.7% for syphilis [13]. However, a previous study of blood donors in Jijiga, Ethiopia Somali Region, found a high seroprevalence of HBV (10.9%), and a low seroprevalence of HIV (0.1%), HCV (0.4) and syphilis (0.1%) [14]. Moreover, a recent study of 494 blood donors attending the Banadir Hospital in Somalia, Mogadishu found a high HBsAg seroprevalence of 9.7% [15].

To the best of our knowledge, however, there are no published data on the seroprevalence of TTIs among blood donors in Somaliland. This study aimed to assess the seroprevalence of HIV, HBV, HCV, and syphilis among blood donors using available screening data from Hargeisa Group Hospital Blood Bank, Hargeisa, Somaliland.

Methods

Study setting and participants

A retrospective cross-sectional study of adult (≥ 16 years) blood donors attending the blood bank of Hargeisa Group Hospital (HGH), Hargeisa, Somaliland between January 1, 2020, and December 31, 2022, was undertaken by using screening data available. HGH is located in Hargeisa, the capital and largest city of the self-declared Republic of Somaliland. The blood bank was established in 2019 and serves HGH which is a governmental regional hospital providing health services to a population of 1.2 million. HGH is also functioning as a referral hospital for the total population of Somaliland, which is estimated to be 4.2 million [16].

Blood donation routines

If a patient needed blood transfusion, the relatives of the patient were routinely asked for blood donation, as non-relative voluntary blood donors were rare. The HGH blood bank did not routinely register the specific type of donor.

The eligibility criteria for blood donation were (1) age between 16 and 75 years of age; (2) body weight ≥ 65 kg; (3) hemoglobin 13.5 mg/dL for males, and 12.5 mg/dL for females. Exclusion criteria were medical history of viral hepatitis or sexually transmitted infections, hypertension, heart condition or seizures the last six months before blood donation.

Screening data

Demographic data of the blood donors and laboratory results were registered manually at the time of donation. Only screening results from first-time donors were included in the analyses, and consequently results from multiple blood donors were excluded. ABO and Rhesus

anti-D blood grouping was determined using monoclonal antibody (anti-A/B/D) red blood cell agglutination tests (Spinreact, Girona, Spain). HIV-1/2 and *Treponema pallidum* antibodies were detected using the rapid diagnostic test (RDT) Standard Q HIV/Syphilis Combo Test (SD Biosensor Inc., Gyeonggi-do, Republic of Korea; detection of HIV antibody, sensitivity: 100%, specificity: 99.9%; detection of *Treponema pallidum* antibodies, sensitivity: 98.8%, specificity: 100%). HBV screening was performed by measuring hepatitis B surface antigen (HBsAg) using the Core Tests® One Step HBsAg RDT (Core Technology Co., Beijing, China; sensitivity: 99.3%; specificity: 99.7%) according to the manufacturer instructions. Anti-HCV antibodies were measured using the Standard Q HCV Ab RDT (SD Biosensor Inc., Gyeonggi-do, Republic of Korea; sensitivity: 100%, specificity: 97.7). Donors testing positive viral hepatitis or syphilis were referred to the medical department at Hargeisa Group Hospital for further investigation and confirmation tests, whereas donors testing positive for HIV were referred to the local HIV treatment center at Hargeisa Group Hospital for further follow-up.

Statistical analysis

All data for this study was obtained from the handwritten records and digitalized by dedicated data clerks before it was quality checked and entered into SPSS version 29.0 (SPSS Inc., Chicago, IL, USA) for statistical analyses. A p-value < 0.05 was considered significant throughout the study. Categorical variables were summarized as frequencies, whereas continuous variables were presented as median and interquartile range. A 95% confidence interval (CI) around sample proportion was calculated using Clopper-Pearson tests. Comparisons between groups were performed using Pearson Chi-Square tests for categorical variables and Mann-Whitney U tests for continuous variables. The *Strengthening the Reporting of Observational studies in Epidemiology* (STROBE) statement guidelines were followed [17].

Ethics

All data were retrospectively collected from electronic databases and written records available at the blood bank department at HGH. The data were fully anonymized before the researchers accessed the data. The institutional Ethical Committee of the University of Hargeisa approved the study before the donor records were retrieved and the need for informed consent to participate was deemed unnecessary according to national regulations by the Ethical Committee of Somaliland Ministry of Health Development which granted ethical clearance (Ref: MOHD/DG:2/843/2023).

Results

Socio-demographic characteristics

A total of 19,021 screening results within the study period were available and no records were excluded since all were first-time blood donors. The vast majority of the blood donors were men (99.8%) and the median age was 29 (interquartile range 25–35) years. The youngest blood donor was 17, whereas the oldest was 73 years of age. The most common blood group was O Rhesus positive (53.5%), whereas AB Rhesus negative or positive were rare (< 0.1%) (Table 1).

Seroprevalence of HIV, HBsAg, anti-HCV and *Treponema pallidum* antibodies

Among the 19,021 blood donors, a total of 11 (0.1%; 95% CI 0.03–0.1) were HIV positive; 226 (1.2%; 95% CI 1.0-1.4) were HBsAg-positive; 17 (0.1%; 95% CI 0.05–0.1) were anti-HCV positive; and 56 (0.3%; 95% CI 0.2–0.4) had detectable *Treponema pallidum* antibodies (Table 2).

No co-infections occurred among the blood donors. Although the numbers were small, there was a significant temporal fluctuation of HBV infection, with a two-fold increase in HBsAg positivity from 2021 to 2022 (0.8% vs. 1.6%; $p < 0.001$).

In total, 310 (1.6%) tested positive for any of the four TTIs screened for, of whom HBV infection was the most common TTI (73%).

All TTI-positive blood donors were men, and no significant differences in relation to sex was found (Table 3).

In general, TTIs were most prevalent among blood donors 26–35 years of age, comprising 151 (48.7%) of the total TTI positives. Among the HBV infected donors there was a significant difference between the age groups, indicating increasing HBsAg positivity with age ($p = 0.007$).

Blood group determination was missing in 84 (0.4%) donors, of whom 83 were infected with TTIs, and thus found ineligible as blood donors, which explains the lack of blood typing in these individuals.

Discussion

To the best of our knowledge, this is the first study presenting seroprevalence of TTIs among blood donors in Somaliland. We found that hepatitis B virus infection was the most common TTI, with an increasing HBsAg positivity with age of the blood donor. Overall, however, the seroprevalence of TTIs was surprisingly low compared to other studies in the region [13–15, 18–20]. Another interesting finding was that the three-year records of blood donations comprised almost exclusively of male blood donors (99.7%). This is, however, in line with similar studies conducted within in the Somali Region of Ethiopia (98.7%) and in Mogadishu, Somalia (97.7%; 99.8%) [14, 15, 21]. This might be explained

Table 1 Socio-demographic characteristics of blood donors attending the Hargeisa Group Hospital, Somaliland 2020–2022

	2020 (*n*=5043)	2021 (*n*=6141)	2022 (*n*=7837)	Total (*n*=19021)
Sex				
Male	5028 (99.7)	6132 (99.9)	7829 (99.9)	18,989 (99.8)
Female	15 (0.3)	9 (0.1)	8 (0.1)	32 (0.2)
Age, years	29 (25–35)	29 (25–34)	29 (25–35)	29 (25–35)
Age group				
16–25	1456 (28.9)	2003 (32.6)	2233 (28.5)	5692 (29.9)
26–35	2485 (49.3)	2891 (47.1)	3940 (50.3)	9316 (49.0)
36–45	898 (17.8)	979 (15.9)	1317 (16.8)	3194 (16.8)
46-55	192 (3.8)	260 (4.2)	312 (4.0)	764 (4.0)
>55	12 (0.2)	8 (0.1)	35 (0.4)	55 (0.3)
Blood group[1]				
O Rh-	123 (2.4)	196 (3.2)	203 (2.6)	522 (2.8)
O Rh+	2599 (51.8)	3278 (53.6)	4256 (53.6)	10,133 (53.5)
A Rh-	81 (1.6)	75 (1.2)	69 (0.9)	225 (1.2)
A Rh+	1341 (26.7)	1614 (26.4)	1956 (25.1)	4911 (25.9)
B Rh-	37 (0.7)	39 (0.6)	54 (0.7)	130 (0.7)
B Rh+	834 (16.6)	911 (14.9)	1263 (16.2)	3008 (15.9)
AB Rh-	2 (<0.1)	0	1 (<0.1)	3 (<0.1)
AB Rh+	5 (0.1)	0	0	5 (<0.1)

Data are presented as number (%) or as median (interquartile range) unless otherwise noted

[1]Blood group determination was missing in 84 donors, of whom 83 were infected with transfusion transmitted infections

Table 2 Blood donors positive for TTIs at Hargeisa Group Hospital, Somaliland 2020–2022

	Total (*n*=19021)	2020 (*n*=5043)	2021 (*n*=6145)	2022 (*n*=7842)	Significance *p*
HBsAg positive	226 (1.2)	57 (1.2)	47 (0.8)	122 (1.6)	<0.001
Anti-HCV positive[1]	17 (0.1)	7 (0.1)	4 (0.1)	6 (0.1)	0.380
HIV positive[2]	11 (0.1)	3 (0.1)	4 (0.1)	4 (0.1)	0.941
Syphilis positive	56 (0.3)	17 (0.3)	17 (0.3)	22 (0.3)	0.807

Data are presented as number (%)

Abbreviations: anti-HCV, hepatitis C virus antibody; **HBsAg**, hepatitis B surface antigen; **HIV**, human immunodeficiency virus; **TTIs**, transfusion transmitted infections

[1]Anti-HCV status was missing in eight blood donors

[2]HIV status was missing in two blood donors

by a social acceptance of the fact that women are more prone to anemia due to pregnancy, menstrual bleeding, and breastfeeding, and thus men are preferred as blood donors above women.

In our study, the seroprevalence of HIV was low (0.1%), which is comparable to other studies among blood donors in adjacent regions in Ethiopia and Somalia with a seroprevalence ranging from 0 to 0.6% [13, 14, 18, 20, 21], although significantly lower than an ancient study in Djibouti which reported a seroprevalence of 1.9% [19]. Our findings concur with the estimated prevalence of HIV in Somalia (< 0.1%), although the data are scarce and there is a lack of representative prevalence studies [22].

Interestingly, we found a substantially lower seroprevalence of HBsAg (1.2%) compared to recent studies among Somali blood donors in Jijiga (Somali region of Ethiopia; 10.9%) and Mogadishu (Somalia; 2.0-19.1%) [13–15, 23]. There is a lack of representative prevalence studies in Somaliland and Somalia, but a previous meta-analysis estimated the pooled prevalence of chronic hepatitis B infection in Somalia to be 18.9%, whereas a recent community-based prevalence study found a prevalence of 12.7% in the Somali region of Ethiopia [24, 25]. One potential explanation for the low seroprevalence of HBsAg observed in our study is selection bias, i.e., individuals with known chronic hepatitis B may have refrained from registering as blood donors. However, considering the limited public awareness of chronic hepatitis B and the absence of screening programs in the country, it is unlikely that this factor significantly influenced our findings. Additionally, due to the donor recruitment practices at Hargeisa Group Hospital, most donations were likely obtained from replacement donors. This contrasts with findings from other studies in the region, which report a higher seroprevalence of HBsAg and a predominance of voluntary donors [15, 18, 20]. Nevertheless, our findings are consistent with those of a recent study conducted at SOS

Table 3 Distribution of TTIs by socio-demographic factors among blood donors at Hargeisa Group Hospital, Somaliland 2020–2022

	Blood donations tested	HBsAg positive	Significance *p*	Anti-HCV positive	Significance *p*	HIV positive	Significance *p*	Syphilis positive	Significance *p*
Sex			1.000		1.000		1.000		1.000
Male	18,989	226 (1.2)		17 (0.1)		11 (0.1)		56 (0.3)	
Female	32	0		0		0		0	
Age group			0.007		0.580		0.513		0.163
16–25	5692	65 (1.1)		2 (<0.1)		1 (<0.1)		12 (0.2)	
26–35	9316	98 (1.1)		10 (0.1)		7 (0.1)		36 (0.4)	
36–45	3194	43 (1.3)		4 (0.1)		3 (0.1)		5 (0.2)	
46-55	764	18 (2.4)		1 (0.1)		0		3 (0.4)	
>55	55	2 (3.6)		0		0		0	
Blood group[1]			0.394		0.773		0.024		0.902
O Rh-	522	7 (1.3)		0		1 (0.2)		2 (0.4)	
O Rh+	10,133	133 (1.3)		10 (0.1)		7 (0.1)		28 (0.3)	
A Rh-	225	0		1 (0.4)		0		0	
A Rh+	4911	46 (0.9)		4 (0.1)		0		17 (0.3)	
B Rh-	130	1 (0.8)		0		1 (0.8)		1 (0.8)	
B Rh+	3008	39 (1.3)		2 (0.1)		2 (0.1)		7 (0.2)	
AB Rh-	3	0		0		0		0	
AB Rh+	5	0		0		0		0	

Data are presented as number (%)

Abbreviations: anti-HCV, hepatitis C virus antibody; **HBsAg**, hepatitis B surface antigen; **HIV**, human immunodeficiency virus; **TTIs**, transfusion transmitted infections

[1]Blood group determination was missing in 84 donors, of whom 83 were infected with transfusion transmitted infections

Heliwa Hospital in Somalia, which reported a similarly low HBsAg seroprevalence (2.0%) among blood donors, over 80% of whom were family donors [21]. Further studies are needed to investigate if differences in donor profiles potentially could influence the estimated seroprevalence. Another explanation for the observed low seroprevalence of HBsAg in our study, might have been that the blood bank at Hargeisa Group Hospital used RDTs to screen blood donations, although RDTs are imperfect screening tools for blood safety due to their reduced sensitivity when serum HBsAg levels are low [26, 27]. For the purpose of population screening and seroprevalence estimates, RDTs are considered reliable tools and the HBsAg RDT used in our study has a high sensitivity and specificity according to the manufacturer [28]. However, the WHO recommends using enzyme-linked immunoassays (ELISA) for screening blood donors and report that nearly 25% of blood donations in low-income countries have been found not following basic quality assured screening procedures [1]. Our findings underline the need for population-based prevalence studies in the region in order to explore the pretest probability for hepatitis B virus infection (and other TTIs) in Somaliland and to reach WHO's goal to eliminate viral hepatitis as a public health threat by 2030 [29].

The low seroprevalence of anti-HCV infection (0.1%) in our study is similar to previous studies in the region (0-0.8%) [13–15, 18–21]. In the neighboring country Ethiopia, the estimated prevalence of anti-HCV is 3.1%, whereas representative prevalence studies are lacking in Somaliland with only a few studies on hepatitis C in Somalia [24, 30]. A previous meta-analysis of prevalence studies among Somali people estimated a pooled anti-HCV prevalence of 4.8% [24]. However, the limited number of studies, the small sample size, and study populations with a high degree of heterogeneity, pinpoints again the need for representative population-based prevalence studies of TTIs in the region.

Although the proportion of positive markers for syphilis in our study (0.3%) was slightly higher than a study from the Somali region of Ethiopia (0.1%) [14], the seroprevalence was lower than other studies in the region with an estimated prevalence ranging from 0.7 to 1.9% [13, 18, 21, 23]. To the best of our knowledge, there is a lack of representative population-based prevalence studies on sexually transmitted infections in Somaliland. A study of vulnerable women in Hargeisa, Somaliland, estimated the prevalence of syphilis to be 2.4% with a decreasing trend from previous surveys [31]. However, the sample size in this survey was small ($n = 96$) and included a highly selected study population, and thus the estimate can hardly be considered as generalizable to the general population.

This study had a number of strengths. Firstly, it had a large sample size from the first governmental blood bank in Somaliland that serves not only the population of Hargeisa but also provides blood donation services to other regions. Secondly, the serological results were consistent with only few missing data throughout the study period. Thirdly, the laboratory tests have been performed in a hospital setting using trained laboratory personnel.

This study also had some limitations. Firstly, confirmatory testing using ELISA was not routinely available; consequently, blood screening relied on RDTs, which are known to have a lower sensitivity and specificity, and thus the estimated seroprevalences of TTIs should be interpreted with caution. Yet more importantly, ELISA is the preferred method for the purpose of blood safety screening in blood banks, especially for HBV which can be transmitted from individuals with even undetectable levels of HBsAg in peripheral blood. Secondly, the blood donors were almost exclusively men, which makes it difficult to indicate a seroprevalence in the general population and impossible to explore differences in the distribution and trends of TTIs among male and female blood donors. Thirdly, as the study was a retrospective review of existing records, the type of donor and other relevant socio-demographic variables and risk factors were not routinely registered and thus could not be included in the data analysis. Moreover, a digital registration system was not available at the blood bank and a suggested measure would be to register the above-mentioned donor information using standardized electronic software in order to improve the quality of the blood bank and ensuring blood safety routines.

Conclusion

Overall, the seroprevalence of TTIs was low compared to other studies in the region. The most common TTI was hepatitis B virus infection and warrants for further community based seroprevalence studies in the country. Moreover, in order to prevent the future risk of TTIs, further studies should be undertaken evaluating the blood screening procedures and monitor the seroprevalence of TTIs in blood banks in Somaliland.

Abbreviations

Anti-HCV	Hepatitis C virus antibody
ELISA	Enzyme-linked immunoassays
HBsAg	Hepatitis B virus surface antigen
HBV	Hepatitis B virus
HCV	Hepatitis C virus
HGH	Hargeisa Group Hospital
HIV	Human immunodeficiency virus
RDT	Rapid diagnostic test
STROBE	Strengthening the Reporting of Observational studies in Epidemiology
TTI	Transfusion transmitted infection
WHO	World Health Organization

Acknowledgements

First, and foremost, we acknowledge the blood donors providing lifesaving supportive care to other patients. We also want to thank the hospital administration and dedicated staff members working at the blood bank at Hargeisa Group hospital. Finally, we are grateful for the support from the University of Hargeisa.

Author contributions

AIF: Investigation; Formal analysis; Data curation; Writing – original draft preparation, review and editing. HMA: Investigation; Data curation; Writing – review and editing. AJM: Data curation; Writing – review and editing. SMA: Data curation; Writing – review and editing. MMI: Data curation; Writing – review and editing. JMQ: Conception; Writing – review and editing. AJ: Conception; Writing – review and editing. SMSO: Conception; Methodology; Formal analysis; Writing - original draft preparation, review and editing.

Funding

Open access funding provided by University of Oslo (incl Oslo University Hospital). This study was funded partly by the University of Hargeisa, Somaliland and partly by Vestfold Hospital Trust, Tønsberg, Norway. The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Data availability

No datasets were generated or analysed during the current study.

Declarations

Ethics approval and consent to participate

The institutional Ethical Committee of the University of Hargeisa which approved the study before the donor records were retrieved and the need for informed consent to participate was deemed unnecessary according to national regulations by the Ethical Committee of Somaliland Ministry of Health Development which granted ethical clearance (Ref: MOHD/DG:2/843/2023).

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

Received: 25 May 2024 / Accepted: 12 August 2025
Published online: 27 August 2025

References

1. World Health Organization. Global status report on blood safety and availability 2021. https://www.who.int/publications/i/item/9789240051683. Accessed 1 Feb 2024.
2. Morar MM, Pitman JP, McFarland W, Bloch EM. The contribution of unsafe blood transfusion to human immunodeficiency virus incidence in sub-Saharan Africa: reexamination of the 5–10% convention. Transfusion. 2016;56:3121–32. https://doi.org/10.1111/trf.13816.
3. World Health Organization. Global progress report on HIV, viral hepatitis and sexually transmitted infections. https://www.who.int/publications/i/item/9789240027077. Accessed 1 Feb 2024.
4. Perkins HA, Busch MP. Transfusion-associated infections: 50 years of relentless challenges and remarkable progress. Transfusion. 2010;50:2080–99. https://doi.org/10.1111/j.1537-2995.2010.02851.x.
5. World Health Organization. Blood safety and availability fact sheet. https://www.who.int/news-room/fact-sheets/detail/blood-safety-and-availability. Accessed 1 Feb 2024.
6. Trépo C, Chan HLY, Lok A. Hepatitis B virus infection. The Lancet. 2014;384:2053–63. https://doi.org/10.1016/S0140-6736(14)60220-8.
7. World Health Organization. Hepatitis C. Key facts. https://www.who.int/news-room/fact-sheets/detail/hepatitis-c. Accessed 1 Feb 2024.
8. World Health Organization. Guidelines for the care and treatment of persons diagnosed with chronic hepatitis C virus infection. https://www.who.int/publications/i/item/9789241550345. Accessed 1 Feb 2024.

9. Prati D. Transmission of hepatitis C virus by blood transfusions and other medical procedures: a global review. J Hepatol. 2006;45:607–16. https://doi.org/10.1016/j.jhep.2006.07.003.
10. World Health Organization. Syphilis. Key facts. https://www.who.int/news-room/fact-sheets/detail/syphilis. Accessed 1 Feb 2024.
11. World Health Organization. Global incidence and prevalence of selected curable sexually transmitted infections—2008. https://apps.who.int/iris/handle/10665/75181. Accessed 1 Feb 2024.
12. Stoltey JE, Cohen SE. Syphilis transmission: a review of the current evidence. Sex Health. 2015;12:103–9. https://doi.org/10.1071/SH14174.
13. Mohamed MOH, Ebar MHO. Seroprevalence of hepatitis B, anti-hepatitis C, human immunodeficiency viruses and *Treponema pallidum* among random blood donors at Somali Sudanese Specialized Hospital (SSSH), Mogadishu, Somalia. J Drug Deliv Ther. 2023;13:42–5.
14. Mohammed Y, Bekele A. Seroprevalence of transfusion transmitted infection among blood donors at Jijiga blood bank, Eastern Ethiopia: retrospective 4 years study infectious diseases. BMC Res Notes. 2016;9:6–11. https://doi.org/10.1186/s13104-016-1925-6.
15. Mohamud AK, Inchon P, Suwannaporn S, Prasert K, Dirie NI. Assessment of prevalence and risk factors associated with hepatitis B virus infection among blood donors in Mogadishu Somalia. BMC Public Health. 2024;24:1–9. https://doi.org/10.1186/s12889-024-18136-2.
16. Central Statistics Department, Ministry of Planning and National Development, Somaliland Government. The Somaliland Health and Demographic Survey 2020. https://somalia.unfpa.org/sites/default/files/pub-pdf/slhds2020_report_2020.pdf. Accessed 1 Feb 2024.
17. von Elm E, Altman DG, Egger M, et al. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. The Lancet. 2007;370:1453–7.
18. Teklemariam Z, Mitiku H, Weldegebreal F. Seroprevalence and trends of transfusion transmitted infections at Harar blood bank in Harari regional state, Eastern Ethiopia: eight years retrospective study. BMC Hematol. 2018;18:1–8. https://doi.org/10.1186/s12878-018-0115-2.
19. Dray X, Dray-Spira R, Bronstein JA, Mattera D. Séroprévalence des virus de l'immunodéficience humaine et des hépatites B et C parmi les donneurs de sang en République de Djibouti [Prevalences of HIV, hepatitis B and hepatitis C in blood donors in the Republic of Djibouti]. Med Trop (Mars). 2005;65:39–42.
20. Abdella S, Berheto TM, Tolera G, Belete W, Deressa T, Feleke A, et al. Seroprevalence of transfusion transmittable infections: HIV, hepatitis B, C and *Treponema pallidum* and associated factors among blood donors in Ethiopia: a retrospective study. PLoS ONE. 2020;15:e0241086. https://doi.org/10.1371/journal.pone.0241086.
21. Dakane MM, Mudei NM, Dahie HA. Seroprevalence of transfusion transmissible infections (TTIS) among blood donors in SOS Hospital Heliwa, Somalia. [PREPRINT]. Available from: https://doi.org/10.2139/ssrn.4662154. Accessed 1 Feb 2024.
22. World Health Organization. Somalia HIV/AIDS country profile 2020. https://www.emro.who.int/asd/country-activities/somalia.html. Accessed 1 Feb 2024.
23. Nur YA, Groen J, Elmi AM, Ott A, Osterhaus ADME. Prevalence of serum antibodies against bloodborne and sexually transmitted agents in selected groups in Somalia. Epidemiol Infect. 2000;124:137–41. https://doi.org/10.1017/s0950268899003441.
24. Hassan-Kadle MA, Osman MS, Ogurtsov PP. Epidemiology of viral hepatitis in Somalia: systematic review and meta-analysis study. World J Gastroenterol. 2018;24:3927–57. https://doi.org/10.3748/wjg.v24.i34.3927.
25. Weldemariam AG. Nationwide seroprevalence of hepatitis B virus infection in Ethiopia: a population-based cross-sectional survey. [In Proceedings of the World Summit on Infectious Diseases and Therapeutics, London, UK, 19–20 March 2020]. J Infect Dis Diagn. 2020;S(1):4.
26. Yuen MF, Wong DKH, Lee CK, Tanaka Y, Allain JP, Fung J, et al. Transmissibility of hepatitis B virus (HBV) infection through blood transfusion from blood donors with occult HBV infection. Clin Infect Dis. 2011;52:624–32. https://doi.org/10.1093/cid/ciq247.
27. Orlien SMS, Ahmed TA, Ismael NY, Berhe Belay N, Kran AMB, Gundersen SG, et al. Field performance of HBsAg rapid diagnostic tests in rural Ethiopia. J Virol Methods. 2021;289:114061. https://doi.org/10.1016/j.jviromet.2020.114061.
28. Core Technology Ltd. instruction manual for Core Tests® One Step HBsAg RDT. https://www.coretests.com/product/show_127.html. Accessed 1 Feb 2024.
29. World Health Organization. Global health sector strategy on viral hepatitis 2016–2021. Towards ending viral hepatitis. https://iris.who.int/handle/10665/246177. Accessed 1 Feb 2024.
30. Belyhun Y, Maier M, Mulu A, Diro E, Liebert UG. Hepatitis viruses in Ethiopia: a systematic review and meta-analysis. BMC Infect Dis. 2016;16:761. https://doi.org/10.1186/s12879-016-2090-1.
31. International Organization for Migration (IOM). Integrated biological and behavioural surveillance survey among vulnerable women in Hargeisa, Somaliland. https://publications.iom.int/books/integrated-biological-and-behavioural-surveillance-survey-among-vulnerable-women-hargeisa. Accessed 1 Feb 2024.

Publisher's Note