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Seroprevalence of Transfusion-Transmitted Infections Among Blood Donors Attending the Regional Hospital Center of Mouila (Southern Gabon)

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Abstract:

- ***Background:***

Transfusion-transmissible infections (TTIs) remain a major public health concern in resource-limited settings. This study aimed to determine the seroprevalence of HBV, HCV, HIV, and syphilis among blood donors in Ngounié province, Gabon, an area previously lacking epidemiological data.

- ***Methods:***

A cross-sectional study was conducted from July 2025 to March 2026 at the Mouila Regional Hospital Center. A total of 482 donors were screened using rapid immunochromatographic assays. Sociodemographic data and behavioral risk factors were collected and analyzed using Python.

- ***Results:***

Donors were predominantly male (94.0%) and family replacements (95.4%). The overall TTI seroprevalence was 14.5%, with specific rates of 4.8% for HBV, 4.6% for syphilis, 3.3% for HCV, and 2.7% for HIV. Four co-infections (HBV/HIV and syphilis/HIV) were detected. No statistically significant associations were found between seropositivity and reported behavioral risk factors, likely due to sample size limitations.

- ***Conclusion:***

The notable TTI burden and overwhelming reliance on family donations highlight significant transfusion risks in southern Gabon. Urgent strategies are needed to promote voluntary non-remunerated blood donation, implement advanced screening techniques (e.g., NAT/ELISA), and strengthen regional epidemiological surveillance to ensure transfusion safety.

Keywords*: Transfusion-Transmissible Infections; Blood Donors; Seroprevalence; Family Replacement Donation; Hepatitis B Virus; Gabon.*

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I. INTRODUCTION

Blood transfusion is an essential therapeutic intervention in the management of obstetric emergencies, severe anemia, trauma, and malignant hematological disorders (1). However, it exposes blood receivers to various infections agents including hepatits B virus (HBV), hepatis C virus (HBC), human deficiency virus (HIV), and and *Treponema pallidum*, the causative agent of syphilis(2). These transfusion-transmitted infections (TTIs) represent a major worldwide public health concern, especially in resource-limited countries(3).

In Central Africa, the seroprevalence of TTI among blood donors varies considerably from one country to another, and even from one region to another within the same country. In Gabon, previous studies conducted in Libreville (Estuary province), Franceville (Haut-Ogooué province) and Koulamoutou (Ogooué-Lolo province) have reported prevalences of (2.68% -7.28%), (1.56–6.2%), (1.3% -3.1 %), (0.89 – 3.3%), respectively for HBV, HCV, HIV, and *T. pallidum* (Bisseye et al., 2018; Eko Mba et al., 2018; Kenguele et al., 2023; Tonda et al., 2017). However, these studies only focus in three out nine provinces of Gabon and underscore the importance of having local data to guide blood safety policies at the provincial level. To date, no published study has documented the seroprevalence of TTI in the Ngounié province, creating an epidemiological gap that hinders public health decision-making.

The objective of this study was to (1) describe the sociodemographic and biological profile of blood donors at the Regional Hospital Center of Mouila (Ngounié province); (2) estimate the seroprevalence of HBV, HCV, HIV, and syphilis; and (3) identify risk factors associated with seropositivity.

II. MATERIAL AND METHODS

➢ *Study Site and Design*

This is a cross-sectional study conducted at the Mouila Regional Hospital (MRHC), the referral hospital for Ngounié Province, located in southern Gabon. The study covered the period from July 2025 to March 2026.

➢ *Study Population and Inclusion Criteria*

The study population consisted of all blood donors registered at the MRHC during the study period. The inclusion criteria were: being between 18 and 65 years of age, weighing at least 50 kg, having completed the standardized donor screening questionnaire, and having provided informed consent to participate. Donors with a temporary or permanent contraindication to donation according to World Health Organization (WHO) criteria were excluded. A total of 482 donors met these criteria and were included.

➢ *Variables Studied*

The variables collected included: (i) sociodemographic data: age, sex, nationality, occupation, body weight, type of donation, and collection period; (ii) ABO blood group and Rh D phenotype; (iii) serological markers for TTI: HBV surface antigen (HBsAg), anti-HCV antibodies (Anti-HCV), combined HIV antigen/antibody test (HIV Ag/Ab, SRV test), and syphilis serology (VDRL/BW); and (iv) behavioral and medical risk factors: history of previous donation, presence of tattoos or piercings, history of documented infection, history of surgical procedures, and having a regular sexual partner.

➢ *ABO Typing and Serological Assays*

ABO typing and Rh D phenotyping were performed using tube agglutination (Anti-A, Anti-B, Anti-AB, Anti-D antisera) according to the manufacturer protocol (Meril Diagnostics Pvt.Ltd., Gujarat, India). Serological screening for TTI was performed using rapid immunochromatographic tests. HBV the MaxiLINE HBsAg Rapid Test, HCV the MaxiLINE HCV Rapid Test, and *Treponema palladium* the MaxiLINE Syphilis/TP Rapid Test (Avecon Healthcare PVT.Ltd, Aryana, INDIA). HIV was screened using the Determine HIV 1/2 SET (Abbot, Illinois, USA).The HIV positive status of screened donors was confirmed by the MaxLINE HIV 1/2 Tri-Line Rapid Test. Any positive reaction resulted in the exclusion of the donation and led to individualized post-test counseling with referral to appropriate medical care.

➢ *Data Collection and Statistical Analysis*

Data were entered and analyzed using Python 3.11 (pandas, scipy, and numpy libraries). Qualitative variables are described by their frequencies and percentages; quantitative variables by their mean, standard deviation (SD), median, and range. Point prevalences were accompanied by 95% confidence intervals calculated using the Wilson method. Associations between risk factors and HIV seropositivity were tested using Pearson's chi-square (χ^2) test or Fisher's exact test when the expected frequencies were less than 5. The threshold for statistical significance was set at $p < 0.05$.

➢ *Ethical Consideration*

The study was conducted in accordance with the principles of the revised Declaration of Helsinki (2013). Written informed consent was obtained from each donor prior to inclusion. The anonymization of records ensured data confidentiality. Any donor who tested positive received individual post-test counseling and was referred to the appropriate services.

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III. RESULTS

➢ *Sociodemographic Characteristics of MHRC Blood Donors (Table 1)*

A total of 482 blood donors were included in the study; of which 94.0% (453) were males. The age ranges from 18 to 55 with a median age of 31. The age group 26–35 was the most represented with 221 donors (45.85%), followed by those aged 18–25 (25.73%), 36–45 (22.2%), and 46–55 (6.22%). One age value was missing (n = 481 for age-related analyses). The mean weight was 65.7 ± 12.3 kg (median: 64 kg), and 98.9% of donors weighed at least 50 kg. Military and security personnel constituted the largest group with 104 donors (21.6%), followed by employees of the private industrial sector (OLAM, 51; 10.6%), unemployed (51; 10.6%), students (69; 14.3%), and drivers (27; 5.6%). The vast majority of blood donors were Gabonese citizens (97.9%) and family donors (95.4%). The distribution of ABO blood groups revealed a predominance of group O, accounting for 313 donors (64.94 %), of whom 99.04% (310) had the O+ phenotype and. The majority of blood donors (99.4%) were Rh negative (Table 1).

➢ *ABO Blood Grouping and Rhesus (Rh) Typing (Table 1)*

Group A was the second most common group with 108 donors (22.4 %, all A+), followed by group B with 56 donors (11.62 %, all B+), and group AB with 5 donors (1.04 %, all AB+).

Table 1: Socio-Demographic Characteristics of Blood Donors Attending the Mouila Regional Hospital Center (MRHC), Southern Gabon.

Variable	Frequency (%)
Gender	
Female	29 (6.0)
Male	453 (94.0)
Age	
18–25	124 (25.73)
26–35	221(45.85)
36–45	107 (22.2)
46–55	30 (6.22)
Weight (kg)	
< 50	5 (1.03)
50–69	328 (68.05)
≥ 70	149 (30.92)
Country of origin	
Gabon	472 (97.9)
Other	10 (2.1)
Donor type	
Family donor	460 (95,4)
VNRD	22 (4.6)
ABO blood groups	
O	313(64.94)
A	108 (22.40)
B	56 (11.62)
AB	5 (1.04)
Rhesus (Rh) type	
Positive	479 (99.4)
Negative	3 (0.6)

VNRD: Voluntary Non Remunerated Donor

➢ *Seroprevalence of Transfusion-Transmissible Infections*

The results of the serological markers are presented in Table 2. Seroprevalences of HBV, HCV, HIV, and syphilis were respectively 4.8% (23/482), 3.3% (16/482), 2.7% (13/482), and 4.6% (22/482).

Four cases of co-infections were identified: one HBV/HIV co-infection (0.2%) and three Syphilis/HIV co-infections (0.6%). However no HBV/HCV, HBV/Syphilis, HCV/HIV, HCV/Syphilis, or triple co-infections were detected in this series. Although rare, these co-infections indicate simultaneous exposure to multiple routes of transmission.

Table 2: Prevalence of Transfusion-Transmissible Infections Among Blood Donors at the MRHC (n=482)

Serological marker	Infection	Positive n (%)	IC 95 %	Negative n (%)
HBsAg	Hepatitis B (HBV)	23 (4.8)	[3.2 – 7.1]	459 (95.2)
Anti-HCV	Hepatitis C (HCV)	16 (3.3)	[2.1 – 5.3]	466 (96.7)
Ag/Ac HIV	HIV Infection	13 (2.7)	[1.6 – 4.6]	469 (97.3)
VDRL/BW	Syphilis	22 (4.6)	[3.0 – 6.8]	460 (95.4)

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Co-infection HBV/HIV	—	1 (0.2)	—	—
Co-infection Syphilis/HIV	—	3 (0.6)	—	—

➢ *Seroprevalence of TTI by Sex and Age Group*

Stratification by sex (Table 3) showed that HBV-positive cases included 22 men (4.9%) and 1 woman (3.4%). For syphilis: 20 men (4.4%) and 2 women (6.9%). For HIV: 13 men (2.9%) and no women. For HCV: 16 men (3.5%) and no women. Despite these apparent differences, Fisher's exact test found no statistically significant association between sex and seropositivity for any of the four markers ($p > 0.05$ in all cases).

The association of TTI with age revealed that HBV seroprevalence increased with age up to the 36-45 age group (7.5%) before declining (3.3% for those aged 46-55), however; this difference was not statistically significant ($\chi^2 = 3.39$; $p = 0.34$). For HIV, prevalence was highest in the 26-35 age group (4.1%) and the 46-55 age group (6.7%), with a non-significant trend ($p = 0.09$). Syphilis rates were higher at the extreme ends of the age interval: 6.5% among those aged 18-25 and 10.0% among those aged 46-55 ($p = 0.17$).

Table 3: Association of HBC, HCV, HIV, and Syphilis with age and Sex (n = 482)

	HBV +		**HCV +**		**Syphilis +**		**HIV +**	
Variable	**n (%)**	**p -value**	**n (%)**	**p -value**	**n (%)**	**p -value**	**n (%)**	**p -value**
Sex								
Male	22 (4.9)	> 0.05	16 (3,5)	> 0.05	20 (4.4)	> 0.05	13 (2.9)	> 0.05
Female	1 (3.4)		0 (0.0)	—	2 (6.9)	—	0 (0.0)	—
Age (years)								
18–25	3 (2.4)	0.34	4 (3.2)	0.98	8 (6.5)	0.17	1 (0.8)	0.09
26–35	11 (4.98)		8 (3.62)	—	6 (2.71)	—	9 (4.07)	—
36–45	8 (7.5)		3 (2.8)	—	4 (3.7)	—	1 (0.9)	—
46–55	1 (3.3)		1 (3.3)	—	3 (10.0)	—	2 (6.7)	—
Total	23 (4.8)		16 (3.3)	—	22 (4.6)	—	13 (2.7)	—

➢ *Risk Factors and Statistical Associations*

The behavioral and medical risk factors identified (Table 4) showed that 139 donors (28.8%) had previously donated blood at least once, 117 (24.3%) reported a history of surgery, 77 (16.0%) had tattoos or piercings, 51 (10.6%) reported having a steady sexual partner, and 22 (4.6%) reported a history of a documented infection.

Analyses of the association between these risk factors and overall seropositivity revealed no statistically significant associations: previous donation ($\chi^2 = 0.59$; $p = 0.44$), tattoos/piercings ($\chi^2 = 0.06$; $p = 0.81$), history of infection ($p = 1.00$), surgery ($\chi^2 = 1.85$; $p = 0.17$), and a steady sexual partner ($\chi^2 = 1.69$; $p = 0.19$).

Table 4: Association of HIV, HBV, HCV, and Syphilis with Risk factors (n = 482)

Risk factor	**Yes n (%)**	**95 %*CI**	**No n (%)**	**χ^2 or Fisher**	**p-value**
Repeat donor	139 (28.8)	[25,0– 33.0]	343 (71.2)	$\chi^2 = 0.59$	0.44
Tatoo/Piercing	77 (16.0)	[13,0– 19.5]	405 (84.0)	$\chi^2 = 0.06$	0.81
Documented history of infection	22(4.6)	[3.0 – 6.8]	460 (95.4)	Fisher	1.00
Surgery operation	117(24.3)	[20.7– 28.3]	365 (75.7)	$\chi^2 = 1.85$	0.17
steady sexual partner	51 (10.6)	[8,1 – 13.6]	431 (89.4)	$\chi^2 = 1.69$	0.19

IV. DISCUSSION

The very high proportion of men in our study (94.0%) is consistent with data published in sub-Saharan Africa, where female participation in blood donation remains low. Indeed rates of 83.7 %, 83%, 85.1% reported respectively in Tanzania, Ghana, and Nigeria (8)(9,10). In Gabon, previous studies reported the same trend with rates of 83.5% and 88.6%(6,7). These gender disparities reflect both sociocultural perceptions linking blood donation to masculine strength and legitimate medical constraints affecting women of childbearing age namely pregnancy, breastfeeding, and menorrhagia. Overcoming these barriers is a key strategy for expanding the pool of potential donors in Mouila. The average age of 31.5 ± 7.8 years and the predominance of the 26–35 age group (45.6%) are consistent with the findings in the African literature (11)(12) and the worldwide trend (1). This distribution highlights the central role of young, working-age adults in family blood donation networks, where it is the relatives of hospitalized patients, typically in their prime, who are mobilized. The predominance of family donations (95.4%) serves as a warning sign for transfusion safety. For the past two decades, the WHO has recommended moving toward a blood supply that relies 100% on voluntary and unpaid donations, which are less susceptible to the risk of concealing risky behaviors under social pressure (2,13). The

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low proportion of voluntary non remunerated donations (4.6%) indicates that a structural effort is needed in Ngounié Province to promote voluntary blood donation. The HBV seroprevalence rate of 4.8% in our study is higher to that reported in a previous study conducted in Franceville (2.68%) and lower than the rates of 7.28 % and 5.9 % reported in Libreville, the capital city of Gabon, (4) and Koulamoutou, a rural region of Gabon (6). This result may reflect the gradual impact of HBV vaccination programs integrated into Gabon's Expanded Program on Immunization (EPI) since 2005, although the lack of vaccination data in our study does not allow us to confirm this. The HCV seroprevalence (3.3%) is comparable to the rate of 4.0 % reported by the systematic conducted in Gabon by Mangala et al (14) and consistent with data from across Africa. In the absence of an HCV vaccine and given that the infection is often asymptomatic, this prevalence underscores the need for effective systematic screening and targeted prevention effort(15). The HIV seroprevalence rate of 2.7 % was similar to Gabon's national prevalence rate, estimated at 2.8 % by UNAIDS in 2026 (16), and fell within the range of (1.3- 3.1%) reported in previous Gabonese studies(6)(5)(7).This result is encouraging but should be interpreted with caution, given the residual serological window of the tests used and the possible underreporting of risky behaviors among family donors under social pressure. The seroprevalence of syphilis (4.6%) was within the range of values reported in Central Africa (1.5 - 18.96 %) (17). Since syphilis is an indicator of risky sexual behavior, its presence among young active donors should lead to a strengthening of sexual health education in donor mobilization campaigns. A notable finding of the present study is the detection of four co-infections (one HBV/HIV co-infection and three syphilis/HIV co-infections). Syphilis/HIV coinfection is biologically plausible, since the ulcerated genital lesions associated with syphilis facilitate HIV acquisition and transmission (18). The detection of these co-infections underscored the importance of simultaneously testing all ITT markers in each donor and referring co-infected donors to specialized care Despite the absence of statistically significant associations, likely due to the study's limited power to detect modest relative risks, several risk factors warrant special attention. The prevalence of tattoos and piercings (16.0%) in our cohort is comparable to the 17.4% reported in the Nederlands by Prinsze et al.(19). These practices represent a known route of transmission for HBV and HCV through the sharing of contaminated equipment (20).Their frequency supports the use of a pre-donation questionnaire that includes a systematic assessment of exposure to these practices.

The proportion of donors with a history of surgery (24.3%) should be considered in the local context, where infection control practices in surgical settings may be inadequate in some peripheral healthcare facilities (21). The presence of a steady sexual partner (10.6%), meanwhile, is a relative protective factor against sexually transmitted infections but does not guarantee the absence of risk, particularly in cases where the partner is an asymptomatic carrier.

➢ *Limitations of the Study*

Although this study provides important information, it has several limitations. First, the study is cross-sectional and does not allow for the establishment of a causal relationship between risk factors and seropositivity. Second, the near-exclusivity of family donations (95.4%) limits the generalizability of the results to a population of voluntary donors. Third, the rapid immunochromatographic tests used may produce false negatives during the early serological window period, likely leading to an underestimation of the actual prevalence. Fourth, the lack of molecular techniques (PCR, NAT) makes it impossible to assess the residual risk of transmission per transfused unit. Fifth, a missing age value and a few data entry errors in the blood type field (entries labeled "0+") indicate that data entry quality could be improved.

V. CONCLUSION

This pioneering study, conducted among 482 donors at the Mouila Regional Hospital Center between July 2025 and March 2026, reveals an overall seroprevalence of TTI of 14.5%, with rates of 4.8% for HBV, 4.6% for syphilis, 3.3% for HCV, and 2.7% for HIV. The detection of four co-infections (one HBV/HIV case and three syphilis/HIV cases) and the predominance of family-based blood donation (95.4%) are two major warning signs highlighting the high transfusion risk in southern Gabon. These results call for urgent action: (1) the expansion of voluntary and unpaid blood donation through campaigns targeting military personnel, corporate employees, and students; (2) the gradual introduction of fourth-generation ELISA techniques or NAT to reduce the serological window; (3) strengthening donor screening through standardized medical interviews and questionnaires; (4) establishing a provincial registry for the epidemiological surveillance of transfusion-transmitted infections; and (5) training CHRM staff in best transfusion practices and post-test counseling.

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➢ *Conflicts of Interest*

The authors declare that they have no conflicts of interest.

➢ *Authors' Contributions*

- Ulrich Lowens ONKASSA-SAH: conceptualization and data collection,
- Thièry MBA NDONG: methodological support, statistical analysis, and initial drafting.
- Kouassi Karl NZAOU-TCHOKOTO: validation of biological data, final review.
- Hilaire MOUNDOUNGA KENGUELE: scientific supervision and critical review.
- All authors approved the final version of the manuscript.

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