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Prevalence of transfusion transmitted infections by mode of donation and remuneration status among blood donors in Georgia, 2018–2023

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Abstract

Global reform of blood transfusion services is underway in the country of Georgia. New legislation mandates exclusive collection of blood from non-remunerated blood donors in Georgia by July 2025. Retrospective data (2018-2023) from the National Blood Donor Registry were analyzed. The prevalence was calculated for human immunodeficiency virus (HIV) antigen/antibody (Ag/Ab), hepatitis C virus antibody (anti-HCV), hepatitis B surface antigen (HBsAg).

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Conflict of interest

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Disclaimer

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The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the U.S. Centers for Disease Control and Prevention, or National Center of Disease Control and Public Health, Georgia.

Results were stratified by remuneration status and mode of donation. Descriptive analysis was performed to elucidate differences in positivity by year and donor type. During 2018–2023, there were a total of 548,530 donations from 221,492 blood donors in Georgia; 68.3% of donors were male and the median age was 34 years (interquartile range: 26–44). Overall, 17.0% were paid, 24.9% were replacement, 47.4% were voluntary non-remunerated blood donors (VNRBD), and 10.7% had ≥ 2 donations of varying remuneration type. Paid donors had an average of 2.5 donations per year, compared to 1.0 for replacement, and 1.1 for VNRBDs. During 2018–2023, the proportions of paid donors decreased (38.8% to 22.1%); the proportions of replacement (19.1% to 26.0%) and VNRBDs (38.7% to 48.3%) increased. Among first-time donors, prevalence decreased during 2018–2023 for anti-HCV (2.0% to 0.9%) but were stable for HBsAg (range: 1.9%–2.1%) and anti-HIV (range: 0.1%–0.2%). Among repeat donors, prevalence of anti-HCV decreased (from 0.3% to 0.2%) while rates were stable for anti-HIV (0.04%–0.1%), and HBsAg (0.1% in all years). The findings underscore the importance of donor retention in concert with efforts to attain exclusive VNRBD.

Keywords

blood transfusion; blood donors; Hepatitis C; Epidemiology; Georgia (Country)

1. INTRODUCTION

A national hepatitis C elimination program is underway in the country of Georgia. The program employs a multifaceted approach spanning health promotion/awareness, prevention (including harm reduction, infection prevention and control, and blood safety), surveillance, testing and linkage to care, with an objective to eliminate hepatitis C. Hepatitis B vaccination is available for free for beneficiaries of the hepatitis C elimination program and other population groups at high risk of infection. A history of blood transfusion was previously identified as being associated with hepatitis C virus (HCV) infection in Georgia[1, 2]. Furthermore, a high HCV seroprevalence was reported in blood donors[3]. Consequently, global reform of blood transfusion services in Georgia was integrated into the hepatitis C elimination program, with support from the “Safe Blood” State program with an overarching goal to harmonize the national transfusion policies and practices with those of the European Union (EU)[4]. Notable areas of blood transfusion services that have been prioritized in Georgia include its regulatory framework (legislation, development of standards and accreditation), a transition to a nonprofit funding model of blood collection centers, exclusive non-remunerated blood donation, improved laboratory testing, and quality oversight[4–6].

Recruitment of voluntary non-remunerated blood donors (VNRBDs) remains an enduring challenge for many low- and middle-income countries (LMICs)[7]. This is the case in Georgia, an upper-middle income country, where a high proportion of the blood supply is still collected from paid or family replacement blood donors. Family replacement refers to friends or family of the intended transfusion recipient who donate either for that individual specifically or are expected to donate to replenish extant transfusion inventories. By contrast and with rare exception, blood for transfusion in the United States (US) and other

high-income countries is collected from VNRBDs. Paid and family replacement donation is discouraged given its established higher risk for the major transfusion-transmissible infections (TTIs) (i.e. human immunodeficiency virus [HIV], hepatitis B virus [HBV], HCV and *T. pallidum* [syphilis])[8]. Paid and family replacement donation is viewed as being potentially coercive, whereby individuals are less likely to admit any behaviors placing them at higher risk of infection, which could result in their deferral[9]. Deferral could invite scrutiny in the case of family replacement donors or prevent earning for paid donors.

New legislation in Georgia, which was developed by the Ministry of Internally Displaced Persons from the Occupied Territories, Health, Labor and Social Affairs of Georgia in partnership with an EU twinning project (i.e. “strengthening blood safety in Georgia”), mandates exclusive collection of blood from non-remunerated blood donors by July 2025. We sought to determine the prevalence and risk of transmission of HCV and the other major transfusion-transmitted viruses (HBV and HIV) according to remuneration status.

2. MATERIAL AND METHODS

2.1. Overview of blood donor testing in Georgia

The donor/donation infrastructure in Georgia has previously been described[5]. Historically, most blood collection centers were for-profit facilities. Paid, family replacement and volunteer blood donation were permissible. Prior to initiation of the hepatitis C elimination program, donors were screened for HIV, HBV, HCV and syphilis by serology alone. In 2020, molecular testing was implemented for HIV, HBV and HCV[6]. Molecular testing was centralized in a single reference laboratory (Richard M. Lugar Center for Public Health Research) at the National Center for Disease Control and Public Health in Tbilisi. By contrast, serological testing is performed by the blood collection centers themselves.

2.2. Source of data

Data were extracted from the national electronic blood donor database in Georgia for the period January 1, 2018, through December 31, 2023. Variables that are captured in the database include donor demographics (age, sex, and region of donation), donation date(s), remuneration status (i.e., VNRBD, family replacement or paid donation), and results of infectious disease testing for HCV (antibody to hepatitis C virus [anti-HCV]), HBV (hepatitis B surface antigen [HBsAg]), and HIV (anti-HIV) as reported by the blood collection centers. Donors who screened positive for any of the infectious markers (i.e., HIV, HBsAg, or anti-HCV) in any of their donations within the study observation period were reported as positive for that marker.

2.3. Data management and statistical analysis

Donor data from January 1, 2015 – December 31, 2017 were evaluated to properly categorize first time vs. repeat donors. Repeat donors were defined as anyone with ≥ 2 donations in the period of January 2015 – December 2023. Findings of prevalence of TTIs from 2015-2017 have been published previously[5]. In the annual analysis, repeat donors were included for each year in which they donated blood. However, for the overall 6-year period (2018-2023) repeat donors were counted only once. Thus, the “overall” data are not

simply a summation of individual years' results. Donors who had more than one donation within the study period with different modes of remuneration were classified separately as having "variable" remuneration status. Age and region of donation were reported based on the donor's first/earliest donation in the analysis period.

We performed descriptive analysis of donation records to elucidate differences in demographics, donor type, remuneration status, and infectious marker prevalence. Factors associated with infection or donor type in bivariate analysis were determined using chi-square tests, with an alpha of 0.05. The Cochran-Armitage test for trend was used to determine changes in TTI reactivity over time. All analysis was conducted using SAS version 9.4 (Cary, North Carolina, USA).

This analysis was conducted in accordance with Georgia's hepatitis C elimination program, and "Safe Blood" State program, which was determined by Georgia's NCDC to be a program evaluation and a non-research public health program activity. The analysis used anonymous program data which was exempt from further IRB review at NCDC.

3. RESULTS

3.1. Characteristics of blood donors in Georgia

During the study observation period (January 1, 2018 to December 31, 2023), there were a total of 548,530 donations representing 221,492 unique blood donors across 25 blood banks in Georgia (Table 1). The number of blood donations per year ranged from 85,285 in 2020 to a high of 93,749 in 2022. Overall, 68.3% (n=151,198) of donors were male, and 65.4% (n=144,408) were aged 18-39 years with a median age of 34 years (interquartile range: 26–44 years). On average there were 91,422 donations per year, corresponding to 25 donations per 1,000 population. The majority (54.1%; n=119,807) of donors were in Tbilisi (the capital city), followed by the regions of Adjara (21.6%; n=47,859), and Imereti (17.2%; n=38,203). Over the six-year period, the number of donors increased in the regions of Adjara (7,449 in 2018 to 16,007 in 2023) and Imereti (6,279 in 2018 to 14,043 in 2023); numbers were stable or decreased in other regions.

Of the 221,492 unique donors, 123,893 (55.9%) were first time donors and 97,599 (44.1%) were repeat donors. The proportion of first time and repeat donors was stable over the observation period. Males (46.3%) were more likely than females (39.3%) to be repeat donors, as were paid donors (69.1%) compared to replacement (23.1%) and VNRBDs (33.5%) (Table 4). Overall, the proportions of paid, replacement, and VNRBDs were 17.0% (n=37,598), 24.9% (n=55,040) and 47.4% (n=104,983) respectively; a further 10.7% (n=23,730) of donors were categorized as "variable" whereby they transitioned from one remuneration status to another at different donation visits (e.g. paid vs voluntary donation). A total of 141 donors had an indeterminate remuneration type as no distinguishing information was recorded in the database. During the study period, the proportion of paid donors decreased from 38.8% (n=20,280) in 2018 to 22.1% (n=13,910) in 2023; the proportion of VNRBDs increased from 38.7% (n=20,238) in 2018 to 48.3% (n=30,423) in 2023, and replacement donors increased from 19.1% (n=9,998) to 26.0% (n=16,374). (Fig.1)

Paid donors had an average of 2.5 donations per year, compared to 1.0 donation per year for replacement, and 1.1 donation per year for VNRBDs.

3.2. Prevalence of Transfusion-Transmitted Infections (TTI) markers by donor type and remuneration status

Of all donors during 2018–2023, 2.7% (n=6,068) were reactive for any of the infectious markers (i.e. HIV, HBV or HCV). The overall prevalence of anti-HIV, anti-HCV, and HBsAg was 0.2% (n=400), 1.1% (n=2,407), and 1.5% (n=3,352) respectively (Table 2). The prevalence of any TTI decreased during 2018–2023 from 2.2% (n=1,130) to 1.4% (n=900) $p < .001$. The anti-HCV seroprevalence decreased by 55% over the analysis period, from 1.1% (n=565) in 2018 to 0.5% (n=307) in 2023 ($p < .001$), while HBsAg and HIV seroprevalence remained relatively stable.

Among 123,893 first-time donors, the overall prevalence of TTIs decreased from 4.2% in 2018 to 2.9% in 2023. Anti-HCV prevalence decreased from 2.0% in 2018 to 0.9% in 2023 ($p < .001$), while the prevalence of HBsAg (range: 1.9%-2.1%) and HIV (range: 0.1%-0.2%) were stable. Among repeat donors, the overall prevalence of TTIs decreased from 0.5% in 2018 to 0.4% in 2023, the prevalence of anti-HCV reactivity decreased from 0.3% to 0.2% ($p = .004$), while prevalence of HIV (range: 0.04%-0.1%) and HBsAg (0.1% for all years) remained stable (Table 2).

Compared to repeat donors, prevalence for any infectious marker was higher among first time donors (4.3% vs 0.8%) and individually for HIV (0.2% vs. 0.1%), anti-HCV (1.6% vs. 0.4%), and HBsAg (2.5% vs. 0.2%) (all $p < .001$) (Table 2).

During 2018–2023, 2.3% (880/37,598) of paid donors, 4.3% (2376/55,040) of replacement donors, 2.5% (2660/104,983) of VNRBDs, and 0.6% (147/23,730) of variable-type donors were reactive to any TTI marker. Prevalence of any TTI was also higher among first time vs. repeat donors by remuneration type, for paid donors (5.4% vs. 0.9%), replacement (5.2% vs. 1.2%), and VNRBDs (3.5% vs. 0.7%) (all $p < .001$) (Table 3).

4. DISCUSSION

The findings, supported by prior studies[5, 10], indicate a decline in prevalence of infectious markers among blood donors in Georgia since inception of the hepatitis C elimination program in 2015. This is consistent with the observed decrease in prevalence in the general population, again highlighting the impact of the hepatitis C elimination program[5, 11]. The prevalence of marker reactivity remained high among first time paid and replacement donors, and was lowest among first time VNRBDs. However, the prevalence of marker reactivity was uniformly low across all categories of repeat donors, yet still lowest among repeat VNRBDs. The overall prevalence among first time and repeat donors combined was lowest among paid donors, due to the fact that paid donors were more than twice as likely to be repeat donors compared to other remuneration types. The substantially higher donation rate among paid donors has important implications for sustainability of the blood supply, and merits broader consideration as Georgia formalizes goals of exclusive non-remunerated blood donation by 2025[4].

Voluntary blood donation is central to blood transfusion safety, having been established as posing the lowest risk of TTIs[5, 8, 9, 12-14]. However, the transition from paid and replacement donation to an exclusively voluntary donor pool is a formidable undertaking. Ironically, VNRBDs are more expensive than replacement or even paid donation, given the need for the infrastructure and personnel to recruit individuals continuously[15]. The appeal of replacement and paid donors is the ability to mobilize those donors rapidly, including in times of emergency. The World Health Organization (WHO) advocates, exclusively, for VNRBDs in large part given the concerns over higher risk of TTIs in paid and replacement donors. A voluntary donor pool is needed to ensure sufficiency and sustainability of the safe blood supply[16]. Establishment of a voluntary non-remunerated donor pool should remain the overarching goal. However, in the context of low-resourced countries, particularly in Africa, safety of the blood supply may be at odds with sufficiency[16]. A position favoring retention rather than remuneration status is not new, having long been proposed, particularly in sub-Saharan Africa where the number of collections fails to meet clinical demand[17-19]. Acknowledging the inherent flaws of the WHO benchmark of blood sufficiency[20], Georgia well exceeds the minimum threshold of 10 blood donations per 1000 population (i.e. donations in Georgia are ~24–26 per 1000 population of donation age). Nonetheless, the study findings demonstrate that the prevalence of infectious marker positivity was lowest among repeat VNRBDs, and also low among repeat paid donors, yet the donation frequency was almost 2.5-fold higher than VNRBDs. This highlights the importance of donor retention rather than simply remuneration status alone.

Globally, data are lacking in regard to the extent to which paid and replacement donation are undertaken and the associated infectious risk. Limited data suggest that infectious risk for paid, replacement and even voluntary donors may vary by region. . For example, paid donation in Africa has been suggested as being driven by poverty[21]. This is particularly high risk as it incentivizes a cadre of donors who donate excessively[16], jeopardizing their own health and/or relying on this model for revenue, in which case they may not respond truthfully to screening questions (e.g. in regarding to infectious risk).

The study has several limitations, notable of which is reliance on blood centers' reporting of results; there is a risk of misclassification of donors given that the distinction of family replacement from voluntary donors may be difficult. This could have led to an underestimation of the proportion of replacement donors, and possible overestimation of marker prevalence among voluntary donors. Multiplex nucleic acid testing was implemented in 2020 using an algorithm whereby resolution of testing at an individual virus level was only performed on samples that were discordant by NAT and serology. Therefore, the data were not included in this analysis, which raises a slight possibility of erroneous, unconfirmed serology results. However, these are unlikely to be associated with donor type so would not substantially impact the study conclusions.

Given the paucity of data on transfusion models in Eastern Europe and Western Asia, Georgia offers a model for other middle-income countries that are modernizing transfusion services in accordance with US and EU standards. The findings suggest continued improvement in blood transfusion safety in Georgia over the observation period, as reflected by a decline in prevalence of HCV and other infectious markers. The findings reiterate the

importance of transitioning to an exclusive voluntary non-remunerated donor pool. They also underscore the importance of donor retention to advance blood transfusion safety.

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REFERENCES

- [1]. Hagan LM, Kasradze A, Salyer SJ, Gamkrelidze A, Alkhazashvili M, Chanturia G, et al. Hepatitis C prevalence and risk factors in Georgia, 2015: setting a baseline for elimination. *BMC Public Health*. 2019;19:480. [PubMed: 32326913]
- [2]. Gamkrelidze A, Shadaker S, Tsereteli M, Alkhazashvili M, Chitadze N, Tskhomelidze I, et al. Nationwide Hepatitis C Serosurvey and Progress Towards Hepatitis C Virus Elimination in the Country of Georgia, 2021. *J Infect Dis*. 2023;228:684–93. [PubMed: 36932731]
- [3]. Butsashvili M, Tsertsvadze T, McNutt LA, Kamkamidze G, Gvetadze R, Badridze N. Prevalence of hepatitis B, hepatitis C, syphilis and HIV in Georgian blood donors. *Eur J Epidemiol*. 2001;17:693–5. [PubMed: 12086085]
- [4]. Shermadini K, Alkhazashvili M, Vrieling H, Smid WM, Getia V, Gamkrelidze A, et al. Blood transfusion service in Georgia. *Transfus Apher Sci*. 2023;62:103807. [PubMed: 37673755]
- [5]. Bloch EM, Kipiani E, Shadaker S, Alkhazashvili M, Gvinjilia L, Kuchuloria T, et al. Blood transfusion safety in the country of Georgia: collateral benefit from a national hepatitis C elimination program. *Transfusion*. 2020;60:1243–52. [PubMed: 32542715]
- [6]. Alkhazashvili M, Bloch EM, Shadaker S, Kuchuloria T, Getia V, Turdziladze A, et al. Advancing blood transfusion safety using molecular detection in the country of Georgia. *Transfus Clin Biol*. 2023;30:307–13. [PubMed: 36907246]
- [7]. Weimer A, Taghy CT, Tapko JB, Gouws C, Tobian AAR, Ness PM, et al. Blood transfusion safety in sub-Saharan Africa: A literature review of changes and challenges in the 21st century. *Transfusion*. 2019;59:412–27. [PubMed: 30615810]
- [8]. Busch MP, Bloch EM, Kleinman S. Prevention of transfusion-transmitted infections. *Blood*. 2019;133:1854–64. [PubMed: 30808637]
- [9]. Grady GF, Chalmers TC. Risk of Post-Transfusion Viral Hepatitis. *N Engl J Med*. 1964;271:337–42. [PubMed: 14171801]
- [10]. Shadaker S, Baliashvili D, Alkhazashvili M, Getia V, Tskhomelidze Schumacher I, Surguladze S, et al. Trends in new hepatitis C virus infections among repeat blood donors - Georgia, 2017-2023. *Transfus Clin Biol*. 2024.
- [11]. Tohme RA, Shadaker S, Adamia E, Khonelidze I, Stvilia K, Getia V, et al. Progress Toward the Elimination of Hepatitis B and Hepatitis C in the Country of Georgia, April 2015-April 2024. *MMWR Morb Mortal Wkly Rep*. 2024;73:660–6. [PubMed: 39088368]
- [12]. Domen RE. Paid-versus-volunteer blood donation in the United States: a historical review. *Transfus Med Rev*. 1995;9:53–9. [PubMed: 7719038]
- [13]. Kalibatas V, Kalibatiene L. Reducing the risk of transfusion-transmitted infectious disease markers in blood and blood component donations: Movement from remunerated to voluntary, non-remunerated donations in Lithuania from 2013 to 2020. *PLoS One*. 2022;17:e0277650. [PubMed: 36378657]
- [14]. Diarra A, Kouriba B, Baby M, Murphy E, Lefrere JJ. HIV, HCV, HBV and syphilis rate of positive donations among blood donations in Mali: lower rates among volunteer blood donors. *Transfus Clin Biol*. 2009;16:444–7. [PubMed: 19896404]
- [15]. Lara AM, Kandulu J, Chisuwo L, Kashoti A, Mundy C, Bates I. Laboratory costs of a hospital-based blood transfusion service in Malawi. *J Clin Pathol*. 2007;60:1117–20. [PubMed: 17412875]
- [16]. Jacobs JW, Bates I, M'Baya B, Eichbaum Q, Louw VJ, Al-Riyami AZ, et al. Ensuring a Safe and Sufficient Global Blood Supply. *N Engl J Med*. 2024.

- [17]. Allain J-P. Volunteer safer than replacement donor blood: a myth revealed by evidence. ISBT Science Series. 2010;5:169–75.
- [18]. Allain JP. Moving on from voluntary non-remunerated donors: who is the best blood donor? Br J Haematol. 2011;154:763–9. [PubMed: 21539535]
- [19]. Tagny CT, Owusu-Ofori S, Mbanya D, Deneys V. The blood donor in sub-Saharan Africa: a review. Transfusion Medicine. 2010;20:1–10.
- [20]. Jacobs JW, Bates I, Cohn CS, Choudhury N, Owusu-Ofori S, Vrielink H, et al. The global blood donation index: an imperfect measure of transfusion need. The Lancet. 2024;404:988–90.
- [21]. Bates I, Manyasi G, Medina Lara A. Reducing replacement donors in Sub-Saharan Africa: challenges and affordability. Transfus Med. 2007;17:434–42. [PubMed: 18067647]

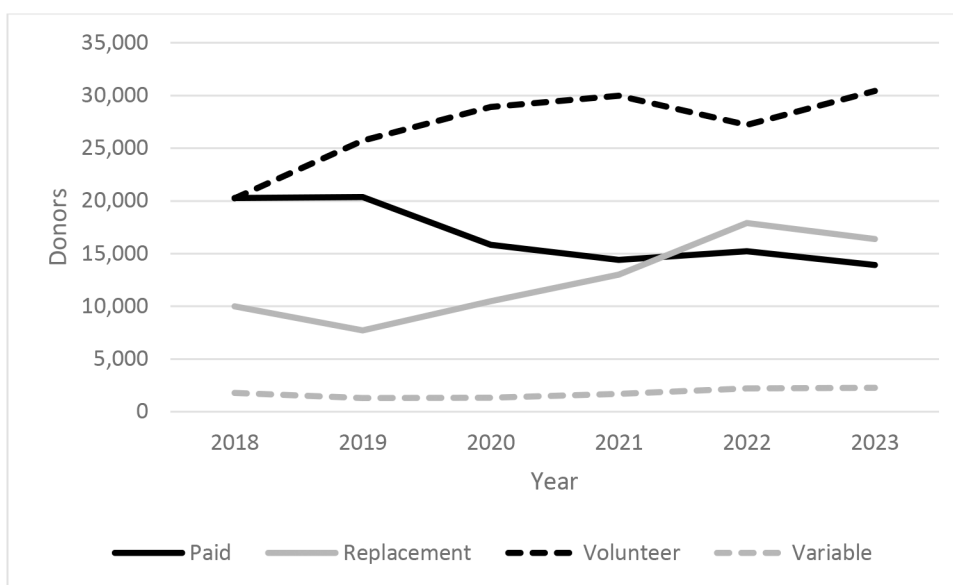


Figure 1:
Blood donors per year by remuneration status, Georgia, 2018-2023

Table 1.

Descriptive analysis of donor population by year, Georgia, 2018-2023

	Overall n (%)	Blood Donation Year n (%)					
		2018	2019	2020	2021	2022	2023
Donations	548,530	92,789	93,193	85,285	90,614	93,749	92,900
Unique Donors	221,492	52,462	55,138	56,562	59,097	62,560	62,967
Sex							
Female	70,294 (31.7)	17,278 (32.9)	18,107 (32.8)	16,552 (29.3)	17,057 (28.9)	17,675 (28.3)	17,473 (27.7)
Male	151,198 (68.3)	35,184 (67.1)	37,031 (67.2)	40,010 (70.7)	42,040 (71.1)	44,885 (71.7)	45,494 (72.3)
Age							
18-29	77,783 (35.1)	22,867 (43.6)	23,114 (41.9)	19,888 (35.2)	20,434 (34.6)	20,206 (32.3)	19,562 (31.1)
30-39	67,025 (30.3)	13,856 (26.4)	15,177 (27.5)	17,232 (30.5)	18,414 (31.2)	19,703 (31.5)	19,475 (30.9)
40-49	45,958 (20.7)	9,578 (18.3)	10,230 (18.6)	11,931 (21.1)	12,361 (20.9)	13,623 (21.8)	14,212 (22.6)
50+	30,726 (13.9)	6,161 (11.7)	6,617 (12.0)	7,511 (13.3)	7,888 (13.3)	9,028 (14.4)	9,718 (15.4)
Region of Donation							
Tbilisi	119,807 (54.1)	33,288 (63.5)	34,161 (62.0)	32,034 (56.6)	32,914 (54.0)	31,184 (49.8)	29,714 (47.2)
Adjara	47,859 (21.6)	7,449 (14.2)	9,655 (17.5)	11,891 (21.0)	14,748 (25.0)	15,824 (25.3)	16,007 (25.4)
Imereti	38,203 (17.2)	6,279 (12.0)	6,161 (11.2)	6,850 (12.1)	7,682 (13.0)	10,915 (17.4)	14,043 (22.3)
Kvemo Kartli	2,694 (1.2)	754 (1.4)	680 (1.2)	1,283 (2.3)	1,218 (2.1)	1,052 (1.7)	967 (1.5)
Samegrelo	5,703 (2.6)	1,557 (3.0)	1,572 (2.9)	1,816 (3.2)	1,429 (2.4)	1,477 (2.4)	17 (0.03)
Shida Kartli	7,226 (3.3)	3,115 (5.9)	2,909 (5.3)	2,688 (4.8)	2,106 (3.6)	2,108 (3.4)	2,219 (3.5)
Donor Type							
First Time	123,893 (55.9)	24,039 (45.8)	24,620 (44.7)	26,011 (46.0)	26,800 (45.3)	27,935 (44.7)	26,736 (42.5)
Repeat	97,599 (44.1)	28,423 (54.2)	30,518 (55.3)	30,551 (54.0)	32,297 (54.7)	34,625 (55.3)	36,231 (57.5)
Remuneration*							
Paid	37,598 (17.0)	20,280 (38.8)	20,371 (37.0)	15,825 (28.0)	14,410 (24.4)	15,220 (24.3)	13,910 (22.1)
Replacement	55,040 (24.9)	9,998 (19.1)	7,725 (14.0)	10,475 (18.5)	13,018 (22.0)	17,916 (28.6)	16,374 (26.0)
Volunteer	104,983 (47.4)	20,238 (38.7)	25,732 (46.7)	28,905 (51.1)	29,989 (50.7)	27,218 (43.5)	30,423 (48.3)
Variable	23,730 (10.7)	1,782 (3.4)	1,299 (2.4)	1,341 (2.4)	1,680 (2.8)	2,205 (3.5)	2,258 (3.6)

* 141 donors with indeterminate remuneration type excluded

Table 2.

Infectious marker prevalence by donor type, Georgia, 2018-2023

	Overall n (%) positive	Donation Year n (%) positive					Cochran- Armitage p-value	
		2018	2019	2020	2021	2022		2023
All Donors								
HBsAg+	3,352 (1.5)	525 (1.0)	560 (1.0)	577 (1.0)	535 (0.9)	611 (1.0)	544 (0.9)	0.01
Anti-HCV+	2,407 (1.1)	565 (1.1)	419 (0.8)	418 (0.7)	358 (0.6)	340 (0.5)	307 (0.5)	<.001
HIV+	400 (0.2)	70 (0.1)	76 (0.1)	71 (0.1)	59 (0.1)	62 (0.1)	63 (0.1)	0.01
Any marker+	6,068 (2.7)	1,130 (2.2)	1,044 (1.9)	1,050 (1.9)	945 (1.6)	1,000 (1.6)	900 (1.4)	<.001
First Time								
HBsAg+	3,112 (2.5)	483 (2.0)	516 (2.1)	536 (2.1)	501 (1.9)	570 (2.0)	506 (1.9)	0.20
Anti-HCV+	1,985 (1.6)	492 (2.0)	336 (1.4)	338 (1.3)	305 (1.1)	286 (1.0)	228 (0.9)	<.001
HIV+	276 (0.2)	51 (0.2)	54 (0.2)	47 (0.2)	41 (0.2)	36 (0.1)	47 (0.2)	0.03
Any marker+	5,286 (4.3)	999 (4.2)	895 (3.6)	905 (3.5)	840 (3.1)	880 (3.2)	767 (2.9)	<.001
Repeat								
HBsAg+	240 (0.2)	42 (0.1)	44 (0.1)	41 (0.1)	34 (0.1)	41 (0.1)	38 (0.1)	0.05
Anti-HCV+	422 (0.4)	73 (0.3)	83 (0.3)	80 (0.3)	53 (0.2)	54 (0.2)	79 (0.2)	0.004
HIV+	124 (0.1)	19 (0.1)	22 (0.1)	24 (0.1)	18 (0.1)	26 (0.1)	16 (0.04)	0.26
Any marker+	782 (0.8)	131 (0.5)	149 (0.5)	145 (0.5)	105 (0.3)	120 (0.3)	133 (0.4)	<.001

Abbreviations: HBsAg = hepatitis B surface antigen; anti-HCV = hepatitis C virus antibody; HIV = human immunodeficiency virus

Table 3.
Prevalence of any infectious marker (HBsAg, anti-HCV, or HIV) by donor type and remuneration status

Overall		Blood Donation Year n (%) positive for any marker							
		n (%) positive	Chi-square p value	2018*	2019*	2020*	2021*	2022*	2023*
Total		6,068 (2.7)	--	1,130 (2.2)	1,044 (1.9)	1,050 (1.9)	945 (1.6)	1,000 (1.6)	900 (1.4)
Donor Type									
First Time		5,286 (4.3)	<.001	999 (4.2)	895 (3.6)	905 (3.5)	840 (3.1)	880 (3.2)	767 (2.9)
Repeat		782 (0.8)		131 (0.5)	149 (0.5)	145 (0.5)	105 (0.3)	120 (0.3)	133 (0.4)
Remuneration**									
Paid		880 (2.3)	<.001	264 (1.3)	175 (0.9)	142 (0.9)	84 (0.6)	140 (0.9)	110 (0.8)
Replacement		2,376 (4.3)		462 (4.6)	332 (4.3)	323 (3.1)	389 (3.0)	505 (2.8)	410 (2.5)
Volunteer		2,660 (2.5)		392 (1.9)	529 (2.1)	583 (2.0)	467 (1.6)	349 (1.3)	376 (1.2)
Variable		147 (0.6)		7 (0.4)	8 (0.6)	2 (0.1)	5 (0.3)	6 (0.3)	4 (0.2)
Donor Type by Remuneration									
Paid		637 (5.5) 243 (0.9)	<.001	190 (5.3) 74 (0.4)	115 (3.5) 60 (0.4)	94 (4.1) 48 (0.4)	63 (2.9) 21 (0.2)	102 (3.4) 38 (0.3)	73 (3.3) 37 (0.3)
First Time Repeat									
Replacement		2,216 (5.2) 160 (1.3)	<.001	440 (5.8) 22 (0.9)	302 (5.5) 30 (1.4)	293 (4.0) 30 (1.0)	362 (4.0) 27 (0.7)	458 (3.9) 47 (0.8)	361 (3.6) 49 (0.8)
First Time Repeat									
Volunteer		2,428 (3.5) 232 (0.7)	<.001	364 (2.9) 28 (0.4)	478 (3.0) 51 (0.5)	518 (3.2) 65 (0.5)	415 (2.7) 52 (0.4)	320 (2.4) 29 (0.2)	333 (2.3) 43 (0.3)
First Time Repeat									

* Chi-square p-value for all comparisons <.001

** 5 donors positive for an infection marker had an indeterminate remuneration type

Table 4.
Characterization of first vs. repeat donors, Georgia, 2018-2023

	Overall n (%)	First-time n (%)	Repeat n (%)	Chi-square p-value
Sex				
Female	70,294 (31.7)	42,701 (60.7)	27,593 (39.3)	<.001
Male	151,198 (68.3)	81,192 (53.7)	70,006 (46.3)	
Age				
18-29	77,783 (35.1)	43,885 (56.4)	33,898 (43.6)	<.001
30-39	67,025 (30.3)	37,381 (55.8)	29,644 (44.2)	
40-49	45,958 (20.7)	25,370 (55.2)	20,588 (44.8)	
50+	30,726 (13.9)	17,257 (56.2)	13,469 (43.8)	
Region of Donation				
Tbilisi	119,807 (54.1)	67,505 (56.3)	52,302 (43.7)	<.001
Adjara	47,859 (21.6)	26,386 (55.1)	21,473 (44.9)	
Imereti	38,203 (17.2)	22,560 (59.1)	15,643 (40.9)	
Kvemo Kartli	2,694 (1.2)	872 (32.4)	1,822 (67.6)	
Samegrelo	5,703 (2.6)	3,737 (65.5)	1,966 (34.5)	
Shida Kartli	7,226 (3.3)	2,833 (39.2)	4,393 (60.8)	
Remuneration*				
Paid	37,598 (17.0)	11,624 (30.9)	25,974 (69.1)	<.001
Replacement	55,040 (24.9)	42,309 (76.9)	12,731 (23.1)	
Volunteer	104,983 (47.4)	69,845 (66.5)	35,138 (33.5)	
Variable	23,730 (10.7)	n/a	23,730 (100.0)	

* 141 donors with indeterminate remuneration type excluded