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Clinical Perspective on Human Immunodeficiency Virus Care of Ukrainian War Refugees in Poland

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(See the Editorial Commentary by Jonathan M. Schapiro on pages 1725–6.)

Background. The Russian invasion of Ukraine forced migration for safety, protection, and assistance. Poland is the primary sheltering country for Ukrainian refugees, providing support including medical care, which resulted in the rapid ∼15% increase in the number of followed-up people with human immunodeficiency virus (HIV) (PWH) in the country. Here, we present the national experience on HIV care provided for refugees from Ukraine.

Methods. Clinical, antiretroviral, immunological, and virologic data from 955 Ukrainian PWH entering care in Poland since February 2022 were analyzed. The dataset included both antiretroviral-treated (n = 851) and newly diagnosed (n = 104) patients. In 76 cases, protease/reverse transcriptase/integrase sequencing was performed to identify drug resistance and subtype.

Results. Most (70.05%) of the patients were female, with a predominance of heterosexual (70.3%) transmissions. Anti–hepatitis C antibody and hepatitis B antigen were present in 28.7% and 2.9% of the patients, respectively. A history of tuberculosis was reported in 10.1% of cases. Among previously treated patients, the viral suppression rate was 89.6%; 77.3% of newly HIV diagnosed cases were diagnosed late (with lymphocyte CD4 count <350 cells/μL or AIDS). The A6 variant was observed in 89.0% of sequences. Transmitted mutations in the reverse transcriptase were found in 15.4% treatment-naive cases. Two patients with treatment failure exhibited multiclass drug resistance.

Conclusions. Migration from Ukraine influences the characteristics of HIV epidemics in Europe, with an increase in the proportion of women and hepatitis C coinfected patients. Antiretroviral treatment efficacy among previously treated refugees was high, with new HIV cases frequently diagnosed late. The A6 subtype was the most common variant.

Keywords. HIV migrant care; antiretroviral treatment efficacy; HIV subtypes; resistance.

The Russian invasion and the beginning of the full-scale war in Ukraine on the 24th of February 2022 resulted not only in internal displacement but also in international migration affecting more than 8 million people [1]. The principal reasons for migration were safety, shelter, protection, coverage of humanitarian needs, and other assistance, including medical care [2]. Multiple countries across the globe have offered shelter and created national protection schemes for refugees. Since the beginning of the war, Poland has remained a primary sheltering country, with more than 6 million border crossings between Ukraine and Poland. More than 1.5 million Ukrainian refugees have registered for protection schemes in Poland, with full, unrestricted access to medical care including prophylactic and treatment programs. However, it needs to be emphasized that the response to the war and provision of shelter are universal across Europe [3].

The human immunodeficiency virus (HIV) disease burden in Ukraine is considerably high. The HIV prevalence level was approximately .66% (95% confidence interval [CI]: .58–.76%) in adults aged 15 years and older and .94% (95% CI: .82–1.08%) in persons aged 15–49 years [4]. Before the Russian invasion, an estimated 260 000 persons with HIV (PWH) were living in Ukraine and 45% of these were female. Approximately 130 000 Ukrainian PWH, including 2700 children and teenagers, received antiretroviral therapy (ART).

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Table 1. Clinical Characteristics of Ukrainian War Migrants Entering Polish HIV Care, Comparing Patients Previously Diagnosed in the Home Country and Those Newly Diagnosed in Poland

	Previously HIV Diagnosed in Ukraine (n = 851)	Newly HIV Diagnosed in Poland (n = 104)	*P*	Total (N = 955)
Age, median (IQR), years	40 (35–46)	37 (30–43)	<.001	40 (35–46)
Gender, n (%)				
Male	240 (28.2)	46 (44.3)	.001	669 (70.1)
Female	611 (71.8)	58 (55.7)		286 (29.9)
Transmission route, n (%)				
Heterosexual	609 (75.8)	70 (70.7)	.51[a]	679 (75.3)
MSM	51 (6.3)	13 (13.1)		64 (7.1)
People who inject drugs	122 (15.2)	15 (15.1)		137 (15.2)
Vertical	16 (2.0)	0		16 (1.8)
Iatrogenic	5 (0.6)	1 (1.0)		6 (0.7)
Lymphocyte CD4 count at care entry, median (IQR), cells/μL	591 (409–802)	184 (27–389)	<.001	561 (346–768)
History of tuberculosis prior to care entry, n (%)				
Yes	64 (10.5)	3 (5.3)	.2	598 (89.9)
No	544 (89.5)	54 (94.7)		67 (10.1)
Coinfection markers				
Hepatitis A (HAV), n (%)				
Anti-HAV IgG antibody				
Reactive	49 (50.0)	21 (44.7)	.55	70 (48.3)
Nonreactive	49 (50.0)	26 (55.3)		75 (51.7)
Hepatitis B (HBV), n (%)				
HBV surface antigen (HBsAg)				
Reactive	17 (2.8)	4 (4.21)	.44	21 (2.9)
Nonreactive	592 (97.2)	91 (95.8)		683 (97.1)
HBV core IgG antibody (anti-HBc)				
Reactive	84 (30.2)	26 (37.1)	.26	110 (31.6)
Nonreactive	194 (69.8)	44 (62.9)		238 (68.4)
HBV surface IgG antibody (anti-HBs)				
Reactive (>10 IU/mL)	39 (16.6)	16 (23.5)	.19	55 (18.2)
Nonreactive (<10 IU/mL)	196 (83.4)	52 (76.5)		248 (81.8)
Hepatitis C (HCV), n (%)				
Anti-HCV IgG antibody				
Reactive	188 (29.7)	21 (22.1)	.12	209 (28.7)
Nonreactive	444 (70.3)	74 (77.9)		518 (71.3)
HCV-RNA[b]				
Detectable	42 (40.4)	12 (66.7)	.03	54 (44.3)
Undetectable	62 (59.6)	6 (33.3)		68 (55.7)
Syphilis non-treponemal serology—VDRL test, n (%)				
Reactive	29 (5.9)	11 (12.4)	.03	40 (6.9)
Nonreactive	463 (94.1)	78 (87.6)		541 (93.1)

Data availability varies for presented variables. Transmission route available for 902 cases, lymphocyte CD4 count at care entry –799 cases, history of tuberculosis for 665 cases, anti-HAV IgG for 145, anti-HBc for 348, HBsAg for 704, anti-HBs for 303, anti-HCV for 727, VDRL for 581 cases.

[a]*P* value calculated for MSM/heterosexual/people who inject drugs transmission route with the exclusion of vertical and iatrogenic transmissions due to low case numbers.

[b]HCV-RNA only collected for anti–HCV-positive cases, available for 122 individuals.

Abbreviations: HIV, human immunodeficiency virus; IgG, immunoglobulin G; IQR, interquartile range; MSM, men who have sex with men; VDRL, Venereal Research Disease Laboratory.

The majority of infections in Ukraine are due to HIV-1 subtype A [5]. The HIV epidemic is still in the concentrated phase with regionalization, and the southeast regions are the most affected because of the war and the related migration [6]. In line with World Health Organization (WHO) antiretroviral treatment guidelines [7], the first-line antiretroviral regimen includes the high-genetic-barrier integrase, single-tablet regimen of tenofovir disoproxil/lamivudine/dolutegravir (TLD). This drug combination is commonly used and provided in approximately 80% of all treated cases [2]. Many of the 390 treatment centers where ART and HIV care were provided are not fully operational due to the war. At least 15 000 patients who initiated treatment in Ukraine may now be lost to follow-up, with 4000 registered patients receiving ART outside the country [8]. Hepatitis B virus (HBV) and hepatitis C virus (HCV) infections also remain a serious public health challenge, with hepatitis B antigen (HBsAg) present in 1.5% of the population and HCV RNA in 3.6%. The prevalence of HBsAg and HCV

antibody (anti-HCV) among people who inject drugs (PWID) is estimated to be 8.5% and 69.7%, respectively [9].

In Poland, HIV prevalence is approximately 0.01%, with 26 486 diagnosed cases as of 31 December 2021. The principal mode of HIV acquisition (>70%) in recent years was through men who have sex with men (MSM) [10]. Approximately 15 500 people were receiving ART before the beginning of the Russian invasion of Ukraine (February 2022).

Since the beginning of the war in Ukraine, 2959 refugees, including 99 children (personal communication, Dr. Anna Marzec-Bogusławska, National AIDS Center; 30 December 2022), have entered HIV care in Poland (causing a >15% increase in the total number of treated cases). This surge poses a challenge to providing ART as well as high-quality care, affecting the medical response to HIV cases.

In this study, we aimed to present the Polish experience on HIV clinical care provided to refugees from Ukraine. Challenges related to language barriers, changes in HIV acquisition routes and subtype variability, an increased number of new HIV diagnoses, and the need for ART modification needed to be faced. These challenges were of key importance from the perspective of medical care and public health responses. With the exacerbating humanitarian crisis in Ukraine and the expected pan-European migration of the refugees, these challenges/issues may need to be addressed globally to facilitate a timely response. New waves of refugees are expected in the forthcoming months due to recent problems in Ukraine's heat and power supply.

METHODS

Patients and Clinical Data Collection

Clinical, antiretroviral, immunological, and virologic data from 955 Ukrainian PWH entering care across Polish HIV treatment centers since February 2022 were collected as per a standardized protocol (Supplementary Material). The dataset included patients seeking medical assistance due to war-associated displacement from Ukraine.

This study was approved by the Bioethical Committee of the Pomeranian Medical University, Szczecin, Poland (approval number BN-001/34/04). It was conducted in accordance with the Declaration of Helsinki. All data were anonymized locally, with no personalized information being used during statistical calculation (pseudo-anonymization); therefore, a waiver from individualized informed consent was provided.

The collected clinical data included patient demographics, such as age; sex; HIV acquisition routes (self-defined by a patient); hepatitis A, B, or C; syphilis coinfection markers; HIV viral load at care entry; lymphocyte CD4 counts; and ART history. Hepatitis B surface antibody (anti-HBs) was deemed reactive if the antibody levels were more than 10 IU/mL, which reflected protection. HCV genotype data were not collected. Clinical history was collected based on a standardized survey and, in limited cases, medical documentation. For newly diagnosed patients, the history of AIDS-defining conditions was based on WHO case clinical staging, whereas late diagnoses were defined according to the recently updated consensus definition [11, 12].

Sequencing, Subtyping, and Drug-Resistance Interpretation

For virological failure and newly diagnosed cases, population protease/reverse transcriptase/integrase sequencing was performed using a previously published methodology [13, 14]. The Stanford database was used to interpret drug resistance (https://hivdb.stanford.edu/). The protease and part of the reverse transcriptase sequence (corresponding to HXB2 genome location positions 2253–3554) were used for subtyping. For subtyping, genotyped sequences were initially assessed using REGAv3 (http://dbpartners.stanford.edu:8080/RegaSubtyping/stanford-hiv/typingtool/) and confirmed by phylogenetic analyses (Supplementary Material).

Statistical Analysis

Statistical comparisons were performed using Fisher's exact and chi-square tests for nominal variables, as appropriate. Continuous variables were analyzed using the Mann–Whitney *U* test for nonparametric statistics. Confidence intervals and interquartile ranges (IQRs) were indicated where appropriate. Commercial software (Statistica 11.0PL; Statasoft, Warsaw, Poland) was used for statistical calculations. Sankey plots were generated using RawGraphs (https://github.com/rawgraphs).

RESULTS

Analyzed Datasets

The final dataset included 851 (89.1%) patients diagnosed in Ukraine and 104 (10.9%) patients newly diagnosed in Poland. The clinical differences between these groups are presented in Table 1. Of these, 127 (13.3%) were lost to follow-up (121 [14.2%] patients previously diagnosed in Ukraine and 6 patients [5.7%] newly diagnosed in Poland). Among the patients diagnosed in Ukraine, 842 (98.9%) had received ART and 9 (1.1%) were treatment-naive. In 5 (4.8%) cases reported as new diagnoses, HIV-1 viral load was undetectable, indicating the possibility of prior diagnosis and ART, which was not disclosed by the patient.

Clinical and Laboratory Characteristics of Ukrainian Refugees With HIV at Care Entry in Poland

The median age of the patients was 40 (IQR: 35–46) years. The majority (70.05%) were female, with a predominance of heterosexual (70.3%) transmissions, followed by 14.2% PWID, 6.6% MSM, 1.65% vertical infections, 0.62% nosocomial infections, and 6.62% undisclosed transmission routes. The median lymphocyte CD4 count at the first visit to the Polish clinical center was 561 (IQR: 346–768) cells/μL.

The analyzed coinfection markers were as follows: hepatitis A antibody (anti-HAV immunoglobulin G [IgG]) in 48.3% of

patients, hepatitis B core antibody (anti-HBc IgG) in 31.6%, HBsAg in 2.9%, anti-HBs greater than 10 IU/mL in 18.2%, and anti-HCV in 28.7%. Hepatitis coinfection markers were more common among PWID (59.6% for anti-HBc IgG and 78.8% for anti-HCV) (Supplementary Table 1). Among 122 patients with reactive anti-HCV antibodies, hepatitis C RNA was detected in 44.3% (n = 54). The Venereal Disease Research Laboratory (VDRL) test was reactive in 6.9% of the samples, with the highest frequency among MSM (22.9%).

A history of tuberculosis (TB) was reported by 67 (10.1%) patients, more frequently by men (13.7%) than by women (8.5%) ($P = .04$), reaching 19.4% among PWID (Supplementary Table 1).

Other reported common HIV- and AIDS-associated comorbidities were pneumonia, including pneumocystosis (6.5%), herpes zoster (5.3%), wasting syndrome (4.9%), and esophageal candidiasis (4.9%) (Supplementary Table 2). Significant underreporting of comorbidities might have occurred due to language barriers and lack of full medical documentation.

Antiretroviral Treatment Patterns and Efficacy

At care entry in Poland, HIV-1 viral load was analyzed in 701 cases. It was undetectable (<50 copies/mL) in 89.6% (n = 628) of the patients, and 5.8% (n = 41) had a viral load greater than 1000 copies/mL. The median lymphocyte CD4 count baseline was 591 (IQR: 409–802) cells/μL. Among the 842 patients treated with antiretroviral drugs, the most common therapy provided by Ukrainian centers was single-tablet TLD (74.3%, n = 626) (Figure 1). In total, 85.4% of patients were on integrase inhibitors, 9.97% on nonnucleoside inhibitors, and 2.7% on protease inhibitor (PI)–based antiretroviral combinations, with 710 (84.3%) patients receiving dolutegravir (DTG)-based regimens. Most patients had initiated ART in the last 5 years (median year of therapy initiation: 2017; IQR: 2012–2019).

When analyzed in the context of antiretroviral drug class, significant differences ($P = .001$) in viral suppression rates (viral load <50 copies/mL) were observed (Figure 2), with the lowest in patients treated with PI-based regimens (65.0%), followed by non-nucleoside reverse transcriptase inhibitor (NNRTI; 78.9%) and integrase inhibitor–based treatment (91.6%). The efficacies of DTG-based and non–DTG-based regimens were 91.71% (n = 553/603) and 76.53% (n = 75/98), respectively ($P < .001$). Virologic suppression rates were similar across transmission groups (90.9% for MSM, 89.9% heterosexually infected, and 89.1% among PWID) and HBsAg (88.2%) and anti-HCV (87.4%)–positive cases. However, notably lower suppression rates were observed among patients with a history of TB (79.63% [n = 43/54] vs 90.79% [n = 404/445]; $P = .01$) and detectable HCV RNA (75.0% [n = 30/40] vs 91.4% [n = 53/58]; $P = .02$).

Due to the limitations in TLD availability in Poland, ART was modified in the majority of patients, most commonly to tenofovir disoproxil/emtricitabine (TDF/FTC) + DTG (37.05%; n = 312) or tenofovir alafenamide/emtricitabine/bictegravir (TAF/FTC/BIC) (32.4%; n = 273) (Figure 1). Overall, 84.2% of 825 patients with available baseline treatment data were switched within the antiretroviral class. In 5.9% of the patients, the antiretroviral drug class was switched, while in 9.81%, treatment was unchanged.

Clinical Characteristics of Newly Diagnosed HIV Cases in the Refugee Population

The median age of the 104 refugees with HIV newly diagnosed in Poland was notably lower than that of Ukraine-diagnosed cases (37 [IQR: 30–43] years vs 40 [IQR: 35–46] years; $P < .001$), with a smaller proportion of men (55.7%) (Table 1). Transmissions by MSM were reported more frequently in this group (13.1%) than in cases diagnosed in Ukraine (6.3%) ($P = .051$). Furthermore, among newly diagnosed cases, higher frequencies of detectable HCV RNA (66.7% vs 40.4%; $P = .03$) and a reactive VDRL test (12.4% vs 5.9%; $P = .03$) were observed compared with patients diagnosed in Ukraine prior to the beginning of war. Late diagnoses were observed in 74.0% (n = 77) of the patients, including 37.5% (n = 39) presenting with an AIDS-defining condition. Acute HIV infection was identified in 1 patient. The most common opportunistic infection was TB (35.9%; n = 14), including 2 cases of multidrug-resistant TB (Supplementary Figure 1). Median lymphocyte CD4 count at diagnosis was 184 (IQR: 27–389) cells/μL and HIV-RNA viral load was 5.03 (IQR: 4.26–5.50) log copies/mL.

HIV-1 Subtypes and Drug-Resistance Mutations

Sequence data were available for 76 patients (23 failing ART and 53 treatment-naive), with subtype A6 being predominant (observed in 89.5% of sequences) (Figure 3).

Among the ART-naive cases, 51 protease/reverse transcriptase sequences were available. In 15.7%, major transmitted drug-resistance mutations were found: in 2 (3.9%) sequences, nucleoside mutations (M41L/T215S and M184V), and in 6 sequences (11.8%), non-nucleoside mutations (E138A in 4 cases and K101E/E138K in 2 cases). No transmitted major protease resistance mutations were observed. Additionally, in 3 (7.55%) of the available 40 integrase sequences, accessory mutations (2 with E157Q and 1 with T97A), but no major integrase mutations, were detected.

In sequences from cases failing ART (all of them infected with the A6 variant), drug-resistance mutations were observed in 8 (34.8%) sequences (Table 2). The most common mutations included nucleoside reverse transcriptase M184V (3 sequences) and nonnucleoside reverse transcriptase E138A/G/Q (5 sequences) mutations. In 2 patients, resistance to 3 drug classes

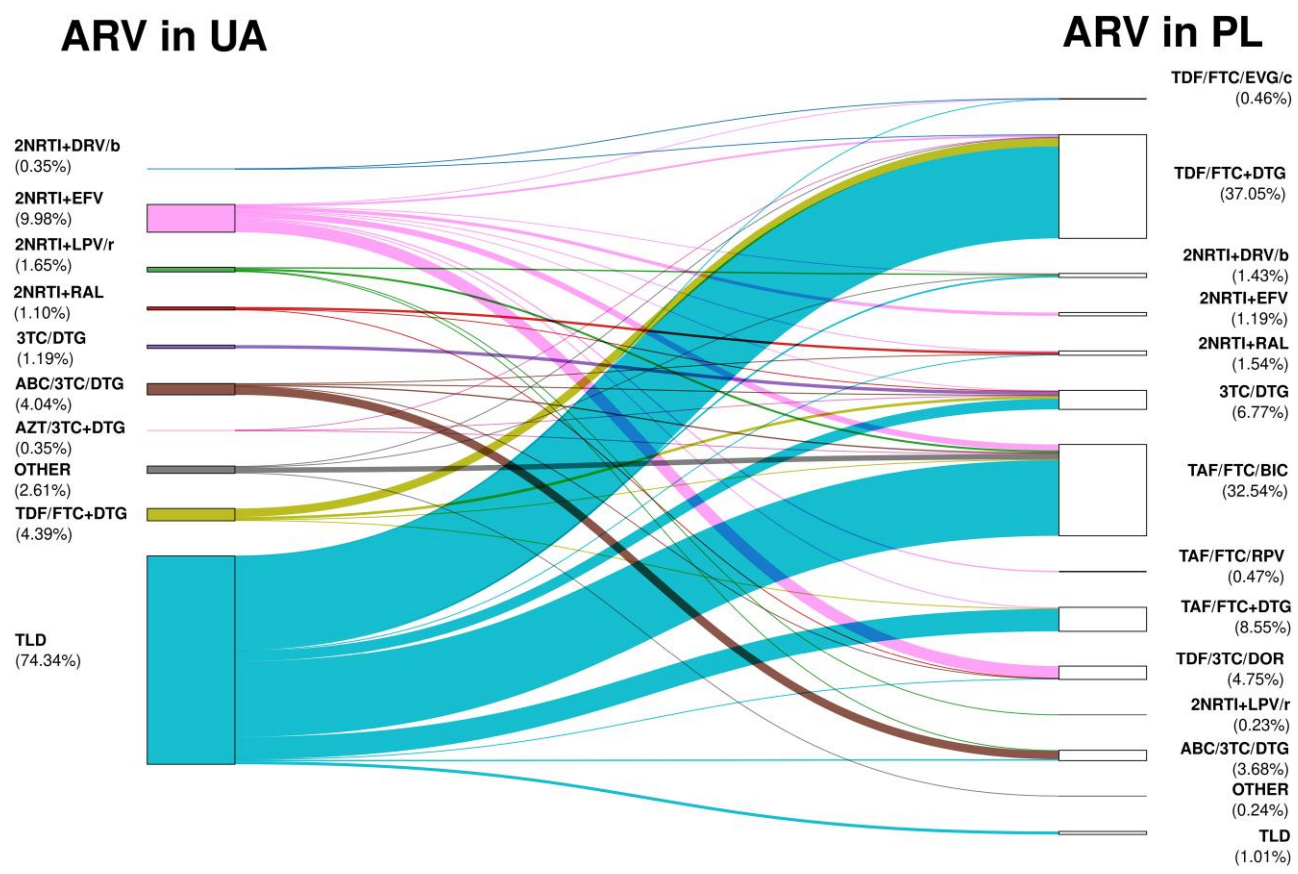

Figure 1. Antiretroviral treatment in patients who actually initiated ART in Ukraine. The left column shows ARVs provided in Ukraine as reported by the patient at care entry, and the right column shows ARVs provided in Poland. The Sankey plot indicates the flow of treatment changes. Abbreviations: ART, antiretroviral therapy; ARV, antiretroviral; AZT, zidovudine; DTG, dolutegravir; EFV, efavirenz; LPV/r, lopinavir + ritonavir; NRTI, nucleoside reverse transcriptase inhibitor; TLD, tenofovir disoproxil/lamivudine/dolutegravir; 3TC, lamivudine.

was observed with NRT/NNRT/Protease mutations in addition to the first Ukrainian refugee case of multidrug resistance with integrase mutations following intermittent TLD exposure. No drug–drug interactions influencing drug plasma levels were reported in these 2 patients.

DISCUSSION

Migration related to the war in Ukraine posed a significant challenge for the medical care systems within the host countries. Here, we present the perspective of HIV infection from Poland, a country receiving the highest number of refugees. We have provided novel and comprehensive large-sample data on the clinical characteristics of previously and newly diagnosed PWH. We have also documented ART characteristics, including its efficacy, hepatitis markers, subtype variability, and drug-resistance mutations. Data are important not only from the perspective of HIV/AIDS but also for planning the public health response in countries providing shelter for this refugee population.

Several important messages emerged from these data. First, sex and transmission group characteristics (mostly heterosexually infected women) are notably different from the long-term patterns observed in Poland and European Union countries, where HIV transmissions are predominantly among MSM [15]. An increasing number of women entering care require the expansion of tailored and integrated services, including gynecological and obstetric care, contraception, and pregnancy management, often in populations with pronounced language barriers.

Furthermore, approximately one-third of the patients entering HIV care exhibit markers of hepatitis C coinfection, and a notable proportion of these had active replication (44%). This is higher than that observed in Poland among patients with HIV/HCV coinfection and other European countries (with an expected <25% of the patients having detectable HCV-RNA) [16]. To meet the WHO HCV elimination targets, the remaining active population with HCV will require direct-acting antiviral treatment within national programs. The proportion of patients with HIV/HBV coinfection with detectable hepatitis B antigen did not exceed 3%, which was lower than the average (5.5%) chronic hepatitis B estimates for European migrant populations [17]. However, the low number of patients with

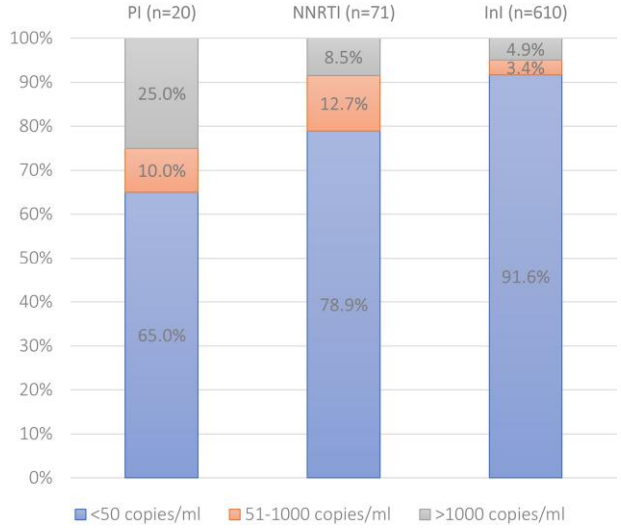

Figure 2. Treatment efficacy according to antiretroviral regimen at care entry in Poland. The data show the first HIV-1 viral load to be analyzed in Poland. Abbreviations: HIV-1, human immunodeficiency virus type 1; InI, integrase inhibitor; NNRTI, nonnucleoside reverse transcriptase inhibitor; PI, protease inhibitor.

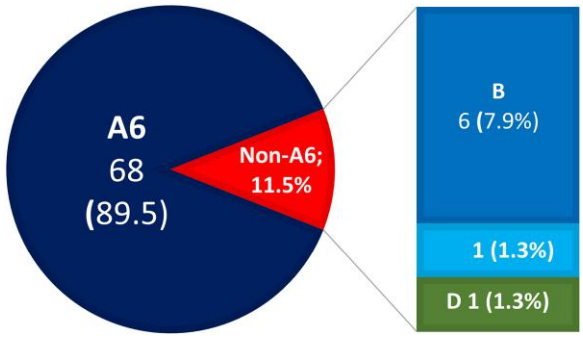

Figure 3. HIV-1 subtype variability among Ukrainian refugees. Abbreviation: HIV-1, human immunodeficiency virus type 1.

anti-HBs levels less than 10 IU/mL indicated the need for a targeted vaccination program.

Two more striking epidemiologic findings became available from our analysis: history of TB was reported by approximately 10% of patients (19.4% among cases reporting injection drug use), while VDRL-based seroprevalence of syphilis was 12.4% and 5.9% among patients newly and previously diagnosed with HIV, respectively, with the highest (22.9%) proportion among MSM. In Europe, syphilis/HIV syndemics among MSM is a well-studied phenomenon, with 34% of MSM patients being HIV positive in 2019 [18]. However, syphilis was infrequently reported in Ukraine [19], with no published data on HIV/syphilis coinfection rates across transmission groups. High TB coinfection rates are alarming but not surprising as Ukraine has one of the highest absolute numbers of incident TB (32 000 in the year 2000) and one of the highest TB mortality rates (9.4% per 100 000 population). It is estimated that 22% of individuals with TB in Ukraine are coinfected with HIV, with more than 90% ART coverage in the population with HIV/TB coinfection [20]. In Ukraine, TB is the principal cause of mortality in hospitalized adult PWH, with a pre-war downward trend in the frequency of deaths related to HIV/TB coinfection (from 25.9% in 2018 to 17.2% in 2021).

Notably, ART efficacy among war refugees entering care reached almost 90%, which was in line with the WHO 90-90-90 target, and was not different from other European cohorts [21, 22]. The highest ART efficacy was associated with treatment using integrase inhibitors, and DTG was the most commonly administered drug. Furthermore, there were no sex or transmission route–associated differences in ART efficacy. However, a history of TB and active hepatitis C coinfection was associated with less favorable ART outcomes. The exact cause of this association requires further investigation. Unfortunately, the majority of patients required an ART switch due to patenting issues and lack of availability of the single-drug TLD combination, with the majority of switches maintaining integrase inhibitors as core ART agents.

As expected, among the newly diagnosed patients, the majority were diagnosed late (74%), with more than one-third having an AIDS-defining condition, with TB being the most common opportunistic infection. Late diagnosis remains frequent throughout Europe, with migration due to the war possibly exacerbating the issue further in the future [23, 24]. A certain proportion of new diagnoses among Ukrainian citizens were due to prolonged coronavirus disease 2019 (COVID-19) hospitalization, which provided HIV testing opportunities [25]. Among newly infected patients, the MSM transmission route was disclosed more commonly compared with the population diagnosed in Ukraine; however, it is uncertain whether this is associated with the fear of stigma in the home country or other causes.

We also provided novel data on subtype variability and drug-resistance patterns among both naive and treatment-failing ART individuals. In line with the previous molecular data, the majority of the cases had subtype A6, which is the predominant variant in Eastern Europe [5]. A6 is currently the second most common variant in Poland [26], and its dispersal, including cross-border transmissions from eastern regions of Ukraine long affected by armed conflict, was recently described by our group [27]. Infections with the HIV-1 A6 variant were identified as a risk factor for the failure of long-acting injectable cabotegravir/rilpivirine in ATLAS/ATLAS 2 M clinical trials [14, 28]. Therefore, an increased number of infections with this variant may have a significant impact on the roll-out of cabotegravir/rilpivirine long-acting injectable therapy in Europe.

Data on HIV-1 drug-resistance patterns in Ukraine are sparse. A recent study identified nonnucleoside reverse transcriptase mutations in 12.7% of the sequences from

Table 2. Drug-Resistance Patterns Among Patients Who Failed Antiretroviral Therapy

Patient ID	Age, Years	Gender	Antiretroviral Exposure	Subtype	NRTI DRMs	NNRTI DRMs	PI DRMs	InI DRMs
1666	44	Female	TDF/3TC/EFV	A6	None	E138A	None	None
46uk	47	Female	TDF/3TC/EFV	A6	None	E138A	None	None
97	35	Female	LPV/r + AZT; FTC/TDF/EFV	A6	None	G190S	None	None
SV180274	48	Male	ABC/3TC/DRV/r	A6	D67del, T69G, L74V, M184V, T215F, K219E	K101E, E138A, G190C	M46I, V82S	None
1732	48	Male	TLD	A6	M41L, V75VIM, M184V, T215F	K101E, E138Q, G190S	None	E138K, Q148R, R263K
36uk	41	Female	TDF/3TC/EFV	A6	None	K101E, E138G	None	None
1601	58	Female	TLD	A6	M184MV	…	…	…
1715	43	Male	TLD	A6	None	V106I, Y188YC	None	None

Abbreviations: AZT, zidovudine; DRM, drug-resistance mutation; DRV/r, darunavir + ritonavir; EFV, efavirenz; InI, integrase inhibitor; FTC - emtricitabine; LPV/r, lopinavir + ritonavir; NNRTI, nonnucleoside reverse transcriptase inhibitor; NRTI, nucleoside reverse transcriptase inhibitor; PI, protease inhibitor; TDF, tenofovir disoproxil fumarate; TLD, tenofovir disoproxil, lamivudine, and dolutegravir; 3TC, lamivudine.

treatment-naive patients from Ukraine [5]. The most commonly identified mutation was E138A, which was in line with the patterns observed in our analysis. In this study, we have reported the first 2 cases of multiple drug resistance, including one with high-level resistance to all integrase inhibitors. This finding underscores the necessity for molecular surveillance to closely monitor emerging resistance patterns.

Limitations of the current analysis include partially incomplete data (which is associated with a lack of a standard of care among refugee populations) and poor access to previous medical history. Standards of care for displaced populations are currently under development. It is likely that newly diagnosed cases were underreported, as diagnoses were made across different centers in the country with possible reporting delays. To address the issue of loss to follow-up, international collaborations and tracing further movement of PWH are necessary.

Conclusions

Migration related to the Russian invasion and war in Ukraine may notably alter the clinical characteristics as well as subtype/resistance patterns in Europe and worldwide. This affects the size of the HIV epidemics in refugee-hosting countries, and requires attentive, stigma-free testing and treatment of HIV, HCV, TB, and sexually transmitted infections. Integrase inhibitor–based treatments prove virologically robust with high rates of virologic responses, even in refugee settings with a possible suboptimal adherence. To prevent late diagnoses, tailored (including home-based) testing programs should be developed with careful consideration of language barriers. Furthermore, molecular epidemiological surveillance of subtype variability and resistance patterns should be maintained.

Supplementary Data

Supplementary materials are available at *Clinical Infectious Diseases* online. Consisting of data provided by the authors to benefit the reader, the posted materials are not copyedited and are the sole responsibility of the authors, so questions or comments should be addressed to the corresponding author.

Notes

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