Evolution of HIV-1 A6 Clusters in Poland Following Full-scale Armed Conflict in Ukraine

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BACKGROUND

→The HIV-1 A6 sub-subtype is among the fastest expanding HIV epidemics in the WHO European Region, with marked prevalence in Russia and Ukraine.

→Since the outbreak of the war in Ukraine, vast population movements have contributed to the increasing spread of the A6 variant across Europe, including Poland. Observed shifts present critical public health challenges.

→Our goal was to assess the changes in phylogenetic clustering patterns and cluster growth of HIV A6 in Poland between 2020 and 2024

METHODS

→We created a dataset of **14,007 unique HIV-1 *pol*** gene fragments of sub-subtype A6 from publicly available sequence databases and included **2,089** sequences **from Poland** sampled between 1996 and 2024

→The dataset was divided into **three data points**: **up to 2020, 2022, and 2024**

→We defined a **cluster as a sample introduced into Poland**, representing a **local transmission chain with a distinct entry point**

→Time-calibration of the maximum-likelihood phylogenetic trees and discrete phylogeographic inference were performed to evaluate distinct clusters

RESULTS

→The number of A6 Polish clusters has increased from **74 in 2020** to 105 in 2022 and **191 in 2024**

→Median cluster sizes were 2 (2–306, n=628), 2 (2–457, n=939), and 2 (2–655, n=1499), respectively

→ The fraction of **females in clusters increased** notably **from 9.0%** (n=28) in the 2020-2022 period **to 19.6%** (n=110; p<0.001) in the two following years, driven mainly by foreign-born women

RESULTS continued

→ The **number of non-clustered** (singleton) **sequences increased significantly from 21.9%** (n=87) to **35.5%** (n=307; p<0.001)

→The proportion of migrants among non-clustered sequences increased from 80.5% (n=70) in the first two years of the study to 90.2% (n=279; p<0.01) in the most recent two years

→We noted a **substantial rise in virus introductions** into the country, with **120 cases in the period of two years before 2022** and **399 importations in the following two years**

→ The A6 sub-subtype epidemic in Poland **evolved rapidly between 2020 and 2024**, driven by **the accumulation of transmission within clusters** and large number of **new introductions**

→ The **epidemic is shifting**, with **rising cluster cases**, particularly among **foreign-born women**

→ **Public health** initiatives must establish a balanced strategy**, focusing on eliminating cluster** networks and **identifying recent importations**

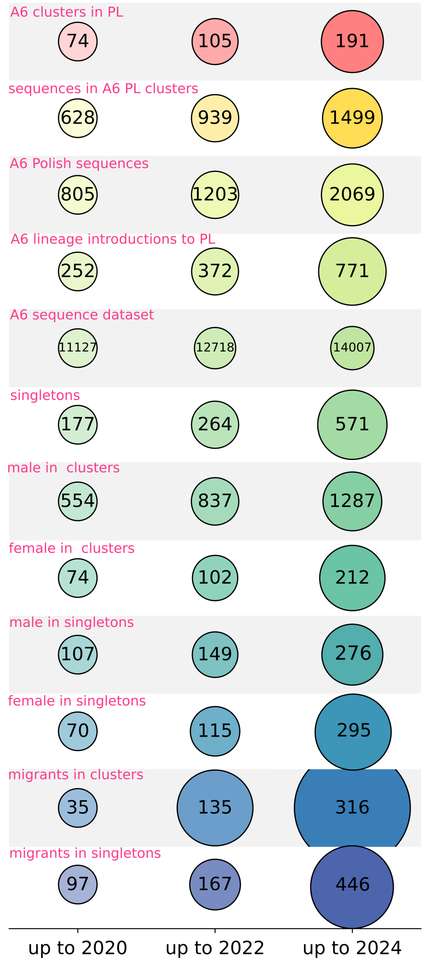
CONCLUSIONS

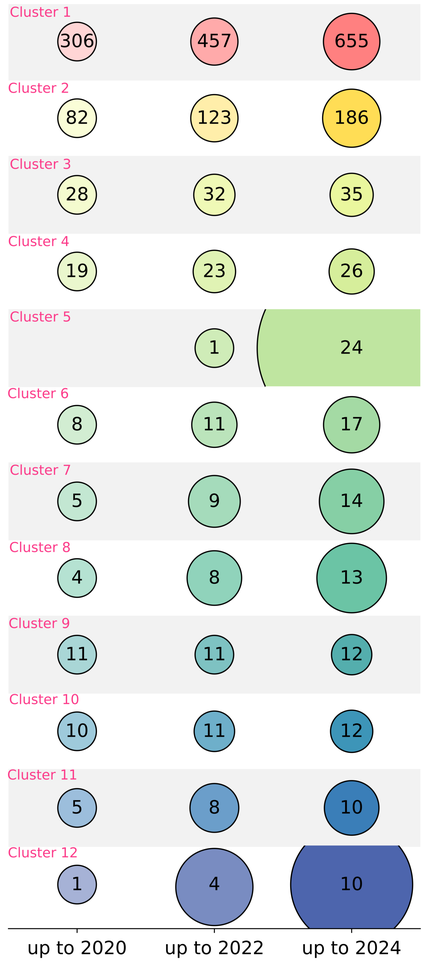
→The **number and size of A6 clusters** in Poland have **increased**, including those involving female sequences

→Large male-dominated clusters continue to drive the spread of the domestic A6 infections

→**Displaced individuals with HIV** who arrived in Poland expand national A6 epidemic as **part of** small clusters and new introductions (**non-clustered sequences**)

→Containing the growth and number of clusters presents healthcare challenge, because resources are constrained by the need to support the large influx of individuals from abroad.





FIGURE

Cluster evolution in Poland. The bubble charts were created separately for each category due to the wide range of values. The points for each category in 2020 are set at 100%, and the increase in point size in subsequent years reflects the percentage change compared to 2020.

→**Left Panel:** Changing patterns of HIV-1A6 epidemic in Poland

→**Right Panel:** Clusters of at least ten sequences in 2024

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