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Comprehensive Analysis of HIV Epidemiology, Transmission, and Immunological Characteristics in the Syrian Arab Republic (SAR)

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ABSTRACT

Background: This study explores the dynamics of HIV in the Syrian Arab Republic, with a focus on long- term epidemiological trends and recent developments (2018– 2020). It examines incidence, transmission pathways, testing outcomes, mortality rates, and immunological characteristics to provide insights into the evolving epidemic within the context of ongoing national challenges.

Methods: A descriptive and analytical epidemiological design was employed using national surveillance records, testing center data, and clinical monitoring systems. Analyses covered historical data (1987– 2014) and detailed demographic, clinical, and treatment outcomes from 2018–2020.

Results: Reported HIV cases increased steadily until peaks in 2006 and 2009, followed by a sharp decline after 2010, coinciding with reduced testing during the crisis and suggesting underreporting. From 2018 to 2020, most cases occurred in adults ≥25 years, with minimal incidence among younger groups. Heterosexual contact was the primary transmission route; homosexual contact and injecting drug use were reported only among men, while blood transfusion and mother-to-child transmission occurred at similarly low rates in both sexes. Mortality declined markedly by 2020 but remained higher among males. Immunological assessment showed low CD4 counts and an inverted CD4/ CD8 ratio. First- line ART regimens, particularly TDF+FTC+EFV, were most frequently prescribed, though treatment interruption and mortality were highest with AZT+3TC+NVP.

Conclusion: Findings highlight the impact of conflict on HIV surveillance and care in Syria. Strong prevention strategies rely on dependable monitoring, and sustained ART access, particularly for high- risk groups, remains critical to reducing transmission and mortality.

INTRODUCTION

Human Immunodeficiency Virus (HIV) and acquired immunodeficiency syndrome (AIDS) are still major health problems around the world. They also affect countries in the Eastern Mediterranean region. Syria has tried to deal with this problem by starting prevention programs, offering medical treatment, and supporting patients [1]. To face HIV in a better way, it is important to study how the disease spreads, how people are diagnosed, how many die from it, and what their health looks like after infection. This study looks at these points and gives information that can help improve public health decisions [2].

Syria began its official fight against HIV/ AIDS in 1987 by creating the National AIDS Commission. This group started awareness campaigns and prevention programs [3]. At the start, no cases were reported. However, the commission educated the public, giving confidential counseling and testing, and providing antiretroviral treatment for people in need. Over the years, Syria has kept the level of HIV/AIDS lower than many other parts of the world [4].

Reports show that HIV in Syria changes with time. During times of crisis, the number of reported cases was low. However, this drop also matched with fewer tests being done, which means some cases may have gone unreported. Most HIV cases spread through heterosexual contact. Other ways, such as homosexual contact and drug injection, played a smaller role. Knowing how HIV spreads is key to planning prevention programs that work for the groups at risk [5].

This study also looks at deaths among people with HIV in Syria. The death rate appears lower compared to other regions, which may be linked to better access to treatment and care [6].

The main goal of this research is to study HIV in Syria over many years. It looks at how the disease spreads, how many people die, and the health status of patients. The results will help guide health policies, improve prevention programs, and make treatments better. Regular follow-up and testing are also important. They help doctors know if treatment is working or if new strategies are needed [7].

METHODS

Study Design

A descriptive and analytical epidemiological design was employed, using statistical analyses and a review of antiretroviral therapy (ART) regimens. The aim was to study HIV incidence, transmission routes, immune status, and treatment outcomes in the Syrian Arab Republic (SAR). The analysis covered two periods: 1987–2014 and 2018–2020.

Data Sources and Collection

Data were obtained from the National HIV/AIDS Monitoring Program in Syria, which serves as the central registry for all HIV-positive cases captured by the national surveillance system.

- For the historical incidence analysis (1987– 2014), annual case counts were compiled from Ministry of Health surveillance reports and the National AIDS Commission registry. These records documented the number of newly confirmed HIV cases per calendar year.

- For the recent period (2018– 2020), detailed individual- level data were extracted, including demographic variables (age, sex), clinical parameters (CD4 and CD8 counts, comorbidities), epidemiological information (mode of transmission, mortality), and ART history.

Note on Data Timeframes

While the ART regimen analysis specifically covers the year 2018 (due to the completeness of the dataset available for that year), the mortality analysis spans the period from 2018 to 2020 to capture longer- term mortality trends. This discrepancy in timeframes was driven by data availability for each specific analysis. We acknowledge that this difference in timeframes may affect the ability to directly correlate trends between ART regimes and mortality outcomes, and we plan to address this in future analyses.

Epidemiological Analysis

A descriptive epidemiological approach was applied to characterize HIV incidence and distribution:

- Historical analysis (1987–2014): Annual counts of newly diagnosed cases were aggregated and plotted as a time-series bar chart to visualize long-term incidence trends. These descriptive data provide historical context for the epidemic's progression in Syria.

- Recent analysis (2018–2020): Data were stratified by age group (0–14, 15–24, and ≥25 years), sex, and year of diagnosis to assess temporal changes and demographic patterns.

An analytical epidemiological approach was used to examine associations between demographic factors, transmission pathways, and treatment outcomes, with emphasis on sex-specific differences.

Immunological Assessment

For a subset of patients, CD4 and CD8 lymphocyte counts were retrieved from clinical records. The minimum, maximum, mean, median, and standard deviation were calculated, and the CD4/CD8 ratio was derived to evaluate immune function and disease progression.

Antiretroviral Therapy (ART) Regimen Analysis

Data on ART utilization were analyzed for the year 2018 (N = 308 patients). Regimens were grouped into fixed-dose combinations or therapeutic classes based on WHO nomenclature, including Viraday (TDF+FTC+EFV), Duovir-N (AZT+3TC+NVP), pediatric 3TC+ABC+LPV/r, Kaletra+Truvada (TDF+FTC+LPV/r), Kaletra+Duovir (AZT+3TC+LPV/r), D4T+ABC+3TC, and LPV/r+ABC+3TC (Kaletra+Abacavir+Lamivudine).

Treatment outcomes were categorized as:

a) Continuing treatment – patients actively on ART at the time of reporting.

b) Interrupted treatment – patients who discontinued ART (loss to follow-up, intolerance).

c) Died – patients deceased during the reporting period.

Frequencies and percentages were calculated for each regimen and outcome category. Data were visualized using stacked bar charts.

Mortality Analysis

Mortality data were stratified by sex and year. Annual mortality rates were calculated relative to the number of HIV-positive cases under follow-up in the national program.

Statistical Analysis

All statistical analyses were conducted using Statistica version 10.0 (StatSoft Inc., Tulsa, OK, USA). Descriptive statistics—including mean, median, standard deviation (SD), minimum, and maximum—were used to summarize continuous variables, whereas categorical variables were expressed as frequencies and percentages. Chi-square tests were applied to assess differences between groups.

To identify temporal trends in HIV incidence, mortality, and ART outcomes, multiple linear and logistic regression models were employed. Note on Data Timeframes: Since the ART regimen analysis is based on 2018 data and mortality analysis spans 2018–2020, the results from these

analyses should be interpreted with caution, particularly when trying to correlate trends between ART regimens and mortality outcomes. Model selection was based on the Akaike Information Criterion (AIC) to ensure optimal fit and parsimony. Model robustness and predictive performance were evaluated using a 10-fold cross-validation procedure, in which the dataset was randomly partitioned into ten subsets; nine were used for training and one for testing in each iteration, and the mean prediction error across folds was computed to assess model stability.

RESULTS

The Syrian crisis interrupted healthcare services, leading to a significant drop in HIV testing. This underreporting is shown in the clear drop in testing numbers during 2010 to 2013. Despite these challenges, the apparent reduction in new cases, particularly among females, should be interpreted cautiously, as it likely reflects both reduced testing coverage during the crisis and possible effects of targeted prevention programs, rather than a definitive decline in true incidence.

HIV Incidence in Syrian Arab Republic (1987–2014)

The official records of newly reported HIV and AIDS cases in Syria from 1987 to 2014 are presented in Figure 1. During the late 1980s and throughout the 1990s, the number of new cases remained relatively low and stable, rarely exceeding 25 cases annually. Beginning in the early 2000s, however, the epidemic showed a consistent gradual increase, with annual reports rising from fewer than 40 cases in 2002 to a peak of 70 cases in both 2006 and 2009. This marked period of increase highlights a critical phase in the country's HIV epidemic, during which transmission and detection became more visible.

Following 2010, the number of newly reported cases declined sharply, with only 14 cases in 2011, 37 in 2012, and fewer than 10 cases annually by 2013–2014. This decline coincided with the disruption of health infrastructure and a dramatic reduction in HIV testing services during the Syrian crisis. The pattern suggests that the apparent fall in reported cases reflects under-detection rather than a true reduction in incidence, underscoring the importance of continuous surveillance for capturing the real dynamics of the epidemic.

Epidemiological Distribution of HIV Incidence by Demographic Characteristics

Between 2010 and 2013, the total number of HIV tests performed nationally declined substantially, with a nearly 70% reduction in 2011 compared with 2010. Sexual contact with confirmed or suspected HIV-positive individuals was the leading indication for testing between 2018 and 2020, whereas blood donors, pregnant women, commuters, and emigrants consistently showed very low HIV positivity rates (data not shown).

The 15–24 age group contributed a smaller proportion of cases, with 9 cases in both 2018 and 2019 (approximately 15% of total incidence in each year) and a reduction to 5 cases in 2020 (16.7%). In contrast, the 0–14 age group contributed minimally, with 2 cases in 2018 and 3 in 2019, and no reported cases in 2020.

These findings confirm that HIV incidence in SAR is predominantly an adult epidemic, disproportionately affecting the 25+ population, while incidence among adolescents and children remains consistently low. The data also reveals a declining trend across all age groups over the three-year period, reflecting a possible reduction in new infections, improved prevention measures, or under-detection in certain age categories.

Modes of HIV Transmission in the Syrian Arab Republic Among the Indigenous Population (1987–2014)

Other routes played a much smaller role. Homosexual transmission appeared only among males, contributing 43 cases (5.6%), while injecting drug use, likewise limited to men, added 15 cases (1.9%). Blood transfusion was responsible for 28 male cases (3.6%) and 11 female cases (1.4%), and mother-to-child transmission occurred at nearly identical levels in both sexes—around 1.3% each.

A notable difference emerges in the “unknown” category: 50 male cases (6.5%) versus only 10 female cases (1.3%).

Altogether, the data highlight the overwhelming contribution of heterosexual exposure to Syria’s HIV epidemic. Women were affected almost entirely through this route, whereas men displayed a broader mixture of exposure pathways, including homosexual contact and injecting drug use.

Figure 3. Distribution of HIV transmission modes among indigenous cases in the Syrian Arab Republic (1987– 2014), shown separately for males (blue) and females (red). Case numbers have been normalized to the officially reported total of 770 cases. Heterosexual contact constitutes the main transmission pathway for both sexes, although it is especially dominant among females. Homosexual transmission and injecting drug use were documented only in males, while mother-to-child transmission and blood transfusion contributed small and nearly similar proportions in both groups. A higher share of male cases fell under the “unknown” category. Percentages in this figure represent cumulative proportions for 1987– 2014 and should not be compared directly with the annual raw counts presented in Figure 4 (2018–2020).

Relative distribution of HIV Transmission Pathways in the Syrian Arab Republic, 2018– 2020, Stratified by Sex

Among males, heterosexual contact consistently represented the main route of transmission, with 31 cases in 2018, 32 in 2019, and 18 in 2020. MSM transmission contributed to smaller numbers 3, 4, and 1 case respectively—while blood transfusion accounted for 2 cases in 2018 and 3 cases in both 2019 and 2020. Injecting drug use appeared only in 2018 (1 case). Mother-to-child transmission contributed to 2 cases in both 2018 and 2019 but disappeared in 2020. The number of cases with an unknown transmission route remained steady in 2018 and 2019 (4 each year) and declined to 2 cases in 2020. Given the sociocultural context and existing stigma around certain sexual behaviors, a proportion of these ‘unknown’ cases may reflect unreported sexual transmission, which aligns with patterns previously observed in similar surveillance settings

Among females, the pattern was narrower but still dominated by heterosexual exposure, which accounted for 13 cases in 2018, 9 in 2019, and 5 in 2020. Blood transfusion contributed to one case each year, while mother-to-child transmission was observed only in 2019 (2 cases). Two female cases were classified as “unknown” in 2018, with none reported afterward. As expected, no female cases were linked to MSM or injecting drug use during the study period.

Taken together, the data show that heterosexual contact remained the primary source of new infections in both sexes. Nonetheless, males exhibited a broader range of secondary transmission routes — including MSM, injecting drug use, and a slightly higher burden of transfusion-related cases—whereas females showed a more restricted pattern centered almost entirely on heterosexual exposure and a small number of transfusion or mother-to-child cases.

Mortality Among HIV-infected Individuals in the Syrian Arab Republic (2018–2020)

Figure 5 shows the mortality trends among HIV-infected individuals in the Syrian Arab Republic between 2018 and 2020, stratified by sex. In 2018, a total of 21 deaths were reported, comprising 18 males and 3 females. This figure represents deaths that occurred during the 2018 calendar year; in contrast, the 39 deaths shown in Figure 8 reflect cumulative treatment outcomes among all patients who initiated ART in 2018, including deaths that occurred after 2018. An equal total of 21 deaths occurred in 2019, with 17 males and 4 females. By 2020, overall mortality declined sharply, with only 7 deaths recorded (6 males and 1 female).

Across the three-year period, mortality was consistently higher among males compared with females, reflecting a persistent sex disparity in HIV-related outcomes. The marked decline in 2020 suggests possible improvements in case management, treatment access, or reporting practices; however, further investigation is needed to clarify the underlying causes of this decline.

CD4 and CD8 T-cell Characteristics in HIV-positive Patients

As shown in Figure 6, CD4 and CD8 T-cell counts in the studied population of HIV-positive patients in Syria demonstrated substantial variability. CD4 counts (N = 135) ranged from 10 to 1954 cells/μL, with a mean of 449.6 cells/μL, a median of 387 cells/μL, and a standard deviation of 323.0. CD8 counts (N = 85) ranged from 23 to 2577 cells/μL, with a mean of 856.7 cells/μL, a median of 770 cells/ μL, and a standard deviation of 510.6, indicating consistently higher absolute CD8 levels relative to CD4 levels.

Panel B of Figure 6 presents the CD4/CD8 ratio, which was uniformly inverted across the cohort, with a mean ratio of 0.52 and a median ratio of 0.50. While an inverted ratio (<1) is characteristic of HIV infection, a ratio near 0.5 represents a more pronounced degree of immune disruption. Such low ratios typically reflect significant CD4 depletion, heightened immune activation, or limited immune reconstitution, and are commonly associated with more advanced immunodeficiency. These findings highlight the substantial immunological compromise observed in many patients within this cohort.

Panel A shows CD4 (N=135) and CD8 (N=85) counts, including the observed range (min–max, horizontal bars), mean ± SD (short ticks), mean (circles), and median (diamonds). CD4 counts ranged from 10 to 1954 cells/μL (mean = 449.6, median = 387), while CD8 counts ranged from 23 to 2577 cells/ μL (mean = 856.7, median = 770), indicating a wider distribution and higher central tendency for CD8 cells. Panel B illustrates the CD4/ CD8 ratio based on mean and median values, both of which were consistently <1 (mean ratio = 0.52; median ratio = 0.50), confirming the inversion of the CD4/CD8 balance typically associated with HIV infection.

Characteristics of HIV-positive Patients Receiving Antiretroviral Therapy

As shown in Figure 7, the study cohort included 201 HIV-positive patients who received antiretroviral therapy in the Syrian Arab Republic. Males represented most of the cohort (65.7%, n=132), whereas females accounted for 34.3% (n=69). A wide spectrum of comorbidities was reported. The most frequent associated conditions were hepatitis C (31.3%, n=63) and tuberculosis (13.9%, n=28). Other notable opportunistic infections included cutaneous mycoses (8.5%, n=17), herpes simplex virus infection (7.5%, n=15), pneumocystis pneumonia (4.5%, n=9), and toxoplasmosis (4.5%, n=9). Less frequent complications such as cytomegalovirus infection (2.5%, n=5), HIV encephalopathy (2.5%, n=5), and recurrent pneumonia (3.5%, n=7) were also observed. Rare conditions included esophageal and tracheobronchial candidiasis, hairy leukoplakia, and peptic ulcer disease, each affecting fewer than 2% of patients.

These comorbidity counts represent the number of diagnoses rather than the number of unique patients, as individuals could have multiple conditions.

Overall, these findings highlight a predominance of male patients and underscore the high burden of co-infections, particularly hepatitis C and tuberculosis, among HIV-positive individuals in Syria.

The cohort shown in Figure 7 (n = 201) represents only the patients who remained on antiretroviral therapy at the time of analysis. These 201 individuals correspond exactly to the ‘continuing treatment’ subset of the 308 patients who initiated ART in 2018, as illustrated in Figure 8.

Panel A shows the sex distribution among patients, with males representing 65.7% and females 34.3%. Panel B illustrates the comorbid conditions identified in this group, with hepatitis C being the most common (63 patients; 31.3%), followed by tuberculosis (28 patients; 13.9%), cutaneous mycoses (17 patients; 8.5%), and herpes simplex virus type 1 infection (15 patients; 7.5%). Less frequent comorbidities included recurrent pneumonia, pneumocystis pneumonia, toxoplasmosis, cytomegalovirus infection, HIV encephalopathy, and peptic ulcer disease. Note: Figure 7 represents only the 201 patients who were alive and continuing ART, corresponding to the “continuing treatment” subset of the initial 308 patients described in Figure 8.

Antiretroviral Therapy Regimens in the Syrian Arab Republic, 2018

Figure 8 shows how antiretroviral therapy (ART) was distributed among HIV-positive patients during 2018 and how each regimen performed over time. In total, 308 individuals received

treatment that year, and their outcomes were categorized as continuing therapy, interrupting treatment, or dying.

Viraday (TDF+FTC+EFV) was by far the most commonly prescribed regimen, reaching 155 patients—just over half of the entire cohort. Most of these patients (118) remained on therapy, while smaller groups interrupted treatment (24) or died (13). The second most widely used combination was Duovir- N (AZT+3TC+NVP), administered to 95 patients. This regimen had a noticeably different pattern: only 40% continued therapy, whereas an equal proportion interrupted treatment, and one in five patients died — representing the highest mortality and interruption levels among all regimens.

Several other combinations were used less frequently but still contributed to the overall treatment landscape. A stavudine-based regimen, D4T+ABC+3TC, was given to 23 patients, all of whom continued treatment; this number corresponds to the full green segment representing this regimen in Figure 8. Kaletra- based combinations — including Kaletra+Truvada (TDF+FTC+LPV/ r) and Kaletra+Duovir (AZT+3TC+LPV/ r) — were used in 16 and 10 patients, respectively, with mixed outcomes. Pediatric patients received a 3TC+ABC+LPV/ r regimen (6 cases, all continued). A small group of three patients received LPV/ r+ABC+3TC, and two of them died.

Taken together, these results show that TDF+FTC+EFV–based therapy remains the backbone of HIV treatment in Syria, while older regimens such as AZT+3TC+NVP continue to be used but are linked to poorer outcomes. The variability across regimens highlights ongoing clinical challenges, especially where treatment interruption and mortality rates are high.

The figure displays the distribution of ART regimens prescribed to 308 patients, along with outcomes classified as continuing treatment, interrupted treatment, or died. Viraday (TDF+FTC+EFV) was the most frequently used regimen (n=155), followed by Duovir- N (AZT+3TC+NVP) (n=95). Less commonly used combinations included D4T+ABC+3TC (n=23), Kaletra+Truvada (TDF+FTC+LPV/r) (n=16), Kaletra+Duovir (AZT+3TC+LPV/r) (n=10), a pediatric regimen of 3TC+ABC+LPV/r (n=6), and LPV/r+ABC+3TC (n=3). Total patient numbers are shown above each bar, with outcome-specific counts displayed within each segment.

Figures

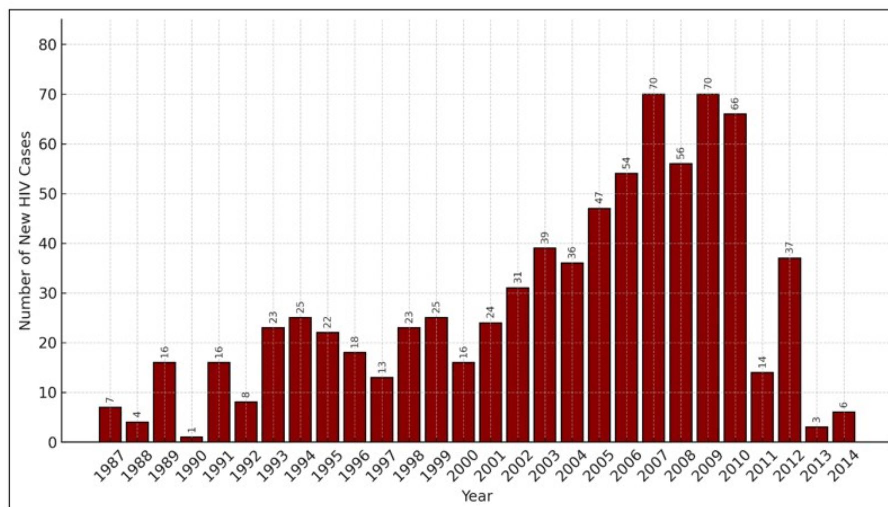

Figure 1: Trends in HIV and AIDS Cases in the Syrian Arab Republic (1987–2014).

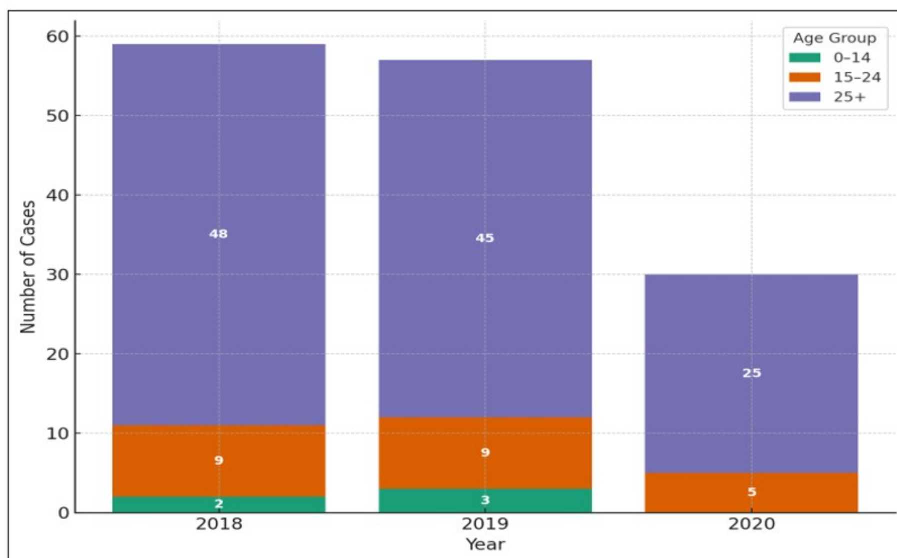

Figure 2: Distribution of reported HIV incidence by age group in the Syrian Arab Republic, 2018–2020.

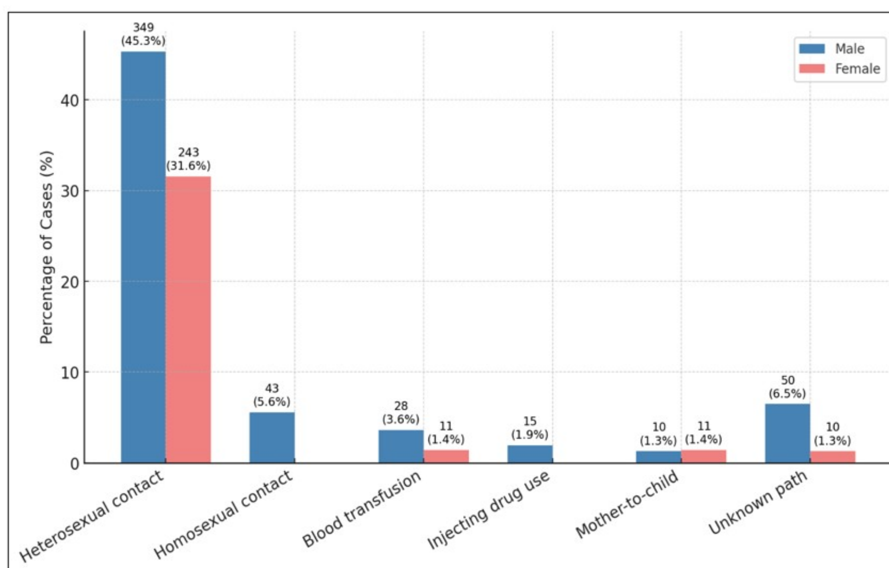

Figure 3: Distribution of HIV transmission modes among indigenous cases in the Syrian Arab Republic (1987–2014), shown separately for males (blue) and females (red).

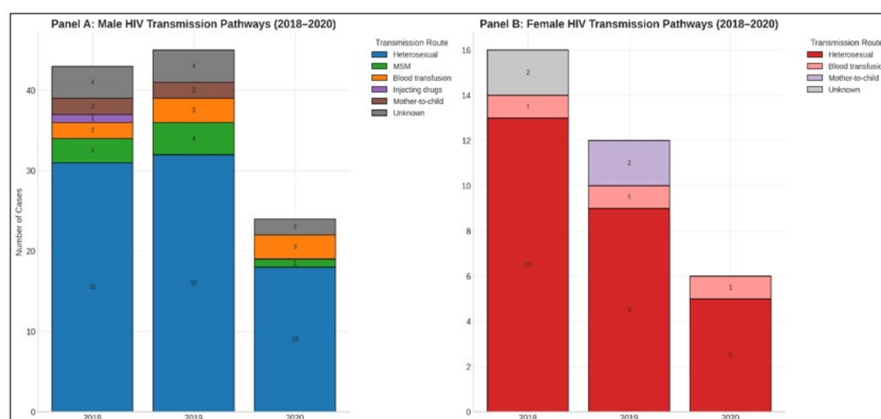

Figure 4: Distribution of HIV transmission pathways among newly reported cases in the Syrian Arab Republic from 2018 to 2020, shown separately for males (Panel A) and females (Panel B).

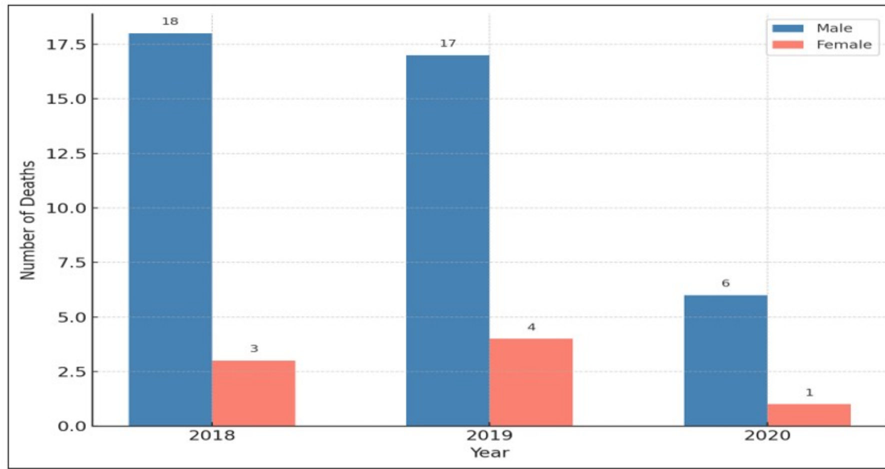

Figure 5: Mortality among HIV-infected individuals in the Syrian Arab Republic, 2018–2020, stratified by sex.

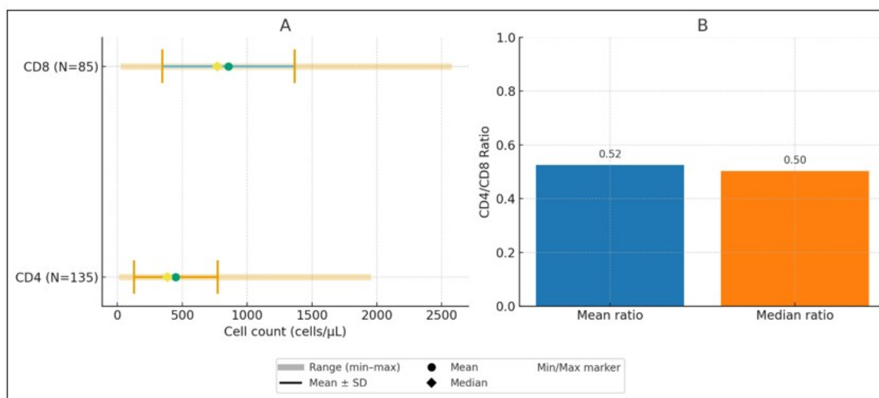

Figure 6: Characteristics of CD4 and CD8 T-cell counts in HIV-positive patients in Syria.

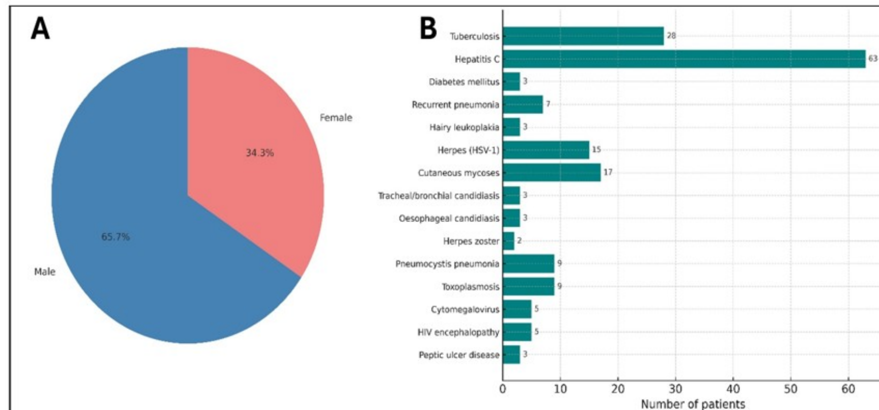

Figure 7: Characteristics of HIV-positive patients receiving antiretroviral therapy in the Syrian Arab Republic.

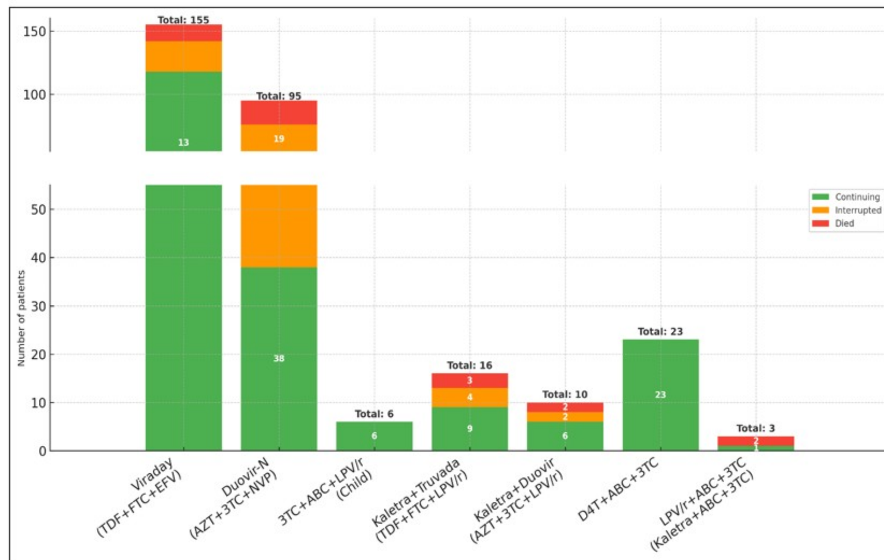

Figure 8: Antiretroviral therapy (ART) regimens and treatment outcomes among HIV-positive patients in the Syrian Arab Republic in 2018.

DISCUSSION

This study highlights the evolving dynamics of HIV epidemiology in the Syrian Arab Republic (SAR). Continuous surveillance, effective treatment strategies, and consideration of the country's socioeconomic context remain essential for the optimal management of HIV. The findings emphasize the need to tailor national HIV programs to Syria's demographic, economic, and public health conditions.

The research presented trends in infection rates, transmission patterns, testing outcomes, mortality, and immunological characteristics among HIV-positive individuals in Syria. The results provide a comprehensive picture of the epidemic and offer valuable insights for evidence-based public health interventions [8].

The findings demonstrate that HIV prevalence and incidence rates in Syria remain comparatively low [9]. While no cases were initially reported, the establishment of the National AIDS Program played a crucial role in raising awareness, improving prevention measures, and expanding access to treatment. The gradual increase in reported cases between 1987 and 2010 was followed by a marked decline during the crisis years (2011– 2014), reflecting the impact of disrupted surveillance systems rather than an actual reduction in incidence [10].

Consistent HIV surveillance in Syria has faced major challenges, including limited healthcare access, population displacement, and interruptions in testing and ART distribution. These barriers complicate data collection and may obscure the true burden of infection. Addressing such gaps requires sustained international collaboration and innovative monitoring strategies. Despite these difficulties, available data continues to yield valuable insights into the transmission dynamics of HIV in the country [2].

Between 2018 and 2020, HIV incidence exhibited moderate fluctuations across age and sex groups. A notable reduction in new infections among females and adults aged 25 years and older likely reflects the success of ongoing prevention and treatment initiatives. These improvements coincide with national campaigns promoting safe sexual practices and expanded ART accessibility [11]. The Syrian crisis, however, significantly affected testing rates and the availability of diagnostic services, contributing to potential underreporting. For instance, the number of HIV tests in 2011 declined by nearly 70% compared with 2010, demonstrating the influence of the crisis on national surveillance capacity.

Heterosexual transmission remains the predominant route of infection in Syria, followed by limited contributions from homosexual contact and injecting drug use [9]. This pattern underscores the importance of maintaining public health education and prevention programs focused on sexual health and awareness [12].

Sexual contact with confirmed or suspected HIV-positive individuals was the most common reason for testing between 2018 and 2020. In contrast, low positivity rates among blood donors, pregnant women, commuters, and emigrants suggest that these groups present relatively lower risk, highlighting the importance of maintaining targeted testing strategies for high-risk populations [13].

While the number of confirmed HIV cases remains relatively small, comparisons between crisis and post-crisis periods should be interpreted cautiously due to changes in testing approaches. The shift from widespread screening to risk-focused testing indicates that positivity percentages reflect differences in testing populations rather than actual incidence rates [14].

It is important to note that Figure 3 presents normalized historical data (1987–2014) scaled to a total of 770 recorded cases, whereas Figure 4 displays the raw numbers of new infections reported between 2018 and 2020 (146 cases in total). Because of this difference in data treatment and the evolution of testing strategies—from broad national screening to focused, high-risk testing — direct numerical comparisons between these periods are not methodologically valid. The two datasets should therefore be interpreted qualitatively to illustrate long-term patterns rather than quantitative changes in incidence.

Mortality among HIV-positive individuals in Syria between 2018 and 2020 remained low, with improved survival likely attributed to increased access to care and ART [9,15].

The immunological profile of HIV-positive patients and the effectiveness of combination therapies were carefully evaluated. The results showed variability in CD4 and CD8 cell counts, CD4/CD8 ratios, and treatment durations across different therapeutic regimens. Continuous monitoring of these immunological parameters is vital for assessing therapeutic responses and optimizing treatment plans [16].

The observed decline in new infections among women during 2018–2020 also reflects the success of prevention programs targeting pregnant women and mothers through antenatal clinics. Integrating voluntary counseling and testing into maternal healthcare has enhanced ART coverage and significantly reduced the risk of vertical transmission [17].

Future studies should further investigate long-term ART outcomes in resource-constrained and crisis-affected environments. Qualitative research exploring sociocultural and behavioral barriers to HIV testing—particularly among high-risk groups such as men who have sex with men (MSM) and intravenous drug users—would also help refine public health strategies and improve community engagement.

Challenges in Surveillance During the Syrian Crisis

The Syrian conflict created substantial obstacles for HIV monitoring and data collection. Widespread displacement, damage to healthcare infrastructure, and interruptions in diagnostic supply chains led to gaps in national reporting. Furthermore, heightened stigma surrounding HIV during periods of instability discouraged individuals from testing or seeking treatment [18].

Conclusion

This study provides updated evidence on the epidemiological characteristics of HIV in Syria. The results demonstrate low and declining prevalence and incidence rates, particularly among women and individuals aged 25 years and older, suggesting encouraging trends in national prevention and treatment programs. The findings reinforce the need for continued education, prevention, and monitoring efforts, particularly in the context of sociopolitical instability. Active surveillance, uninterrupted ART availability, and individualized treatment strategies are essential to sustain these positive outcomes.

Study Limitations

This study faced certain limitations, including incomplete records and disruptions in data

collection during the Syrian crisis, which may have led to underestimation among some high-risk groups such as MSM and intravenous drug users. In addition, reliance on self-reported modes of transmission may introduce social desirability bias, especially in contexts where HIV-related stigma persists. Despite these constraints, the present study offers valuable insights into the epidemiological and immunological landscape of HIV within a challenging sociopolitical environment.

AUTHOR CONTRIBUTIONS

Yulia Sh. Gushchina conceived and designed the study, supervised data collection, performed the statistical analysis, interpreted the results, and drafted the manuscript. Aleksey Abramov supervised the research, provided methodological and statistical guidance, and critically reviewed and edited the manuscript. Omar Al Bawareed collected and curated the data, contributed to statistical analysis, managed the project and funding, and assisted in revising the manuscript.

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