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HIV Seroprevalence and Screening Practices Among Cancer Patients Receiving Immune Checkpoint Inhibitors: A Single-Center Study From Türkiye

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ABSTRACT

Objective: HIV infection affects the immune system and may influence the safety and efficacy of immune checkpoint inhibitors (ICIs). This study aimed to evaluate HIV seroprevalence among cancer patients receiving ICIs and contextualize the findings using national prevalence estimates.

Materials and Methods: We retrospectively analyzed 590 patients treated with ICIs between January 2015 and July 2025. Viral serology, including anti-HIV, hepatitis B virus (HBV), and hepatitis C virus (HCV) markers, was evaluated. HIV positivity was defined based on confirmatory testing. Statistical analyses were performed using SPSS, version 27.

Results: The median age was 65 years (IQR, 55–73 years), and 65.9% of the patients were male. The most common diagnoses were melanoma (37.4%), genitourinary tumors (26.4%), and lung cancer (21.5%). Viral serology results were available for 354 patients (60%). Only one patient had confirmed HIV positivity, corresponding to a prevalence of 0.28% (exact 95% CI, 0.007–1.56%). This patient had metastatic melanoma and tested negative for HBV and HCV. The observed point estimate was numerically similar to the reported national adult HIV prevalence estimates in Türkiye (0.1–0.2%). Patients tested for HIV were younger and more likely to have comorbidities, and the distribution of tumor types differed between tested and untested patients. In the multivariable analysis, younger age, the presence of comorbidities, and tumor type were independently associated with HIV testing.

Conclusion: HIV prevalence among cancer patients treated with ICIs was low. Given the incomplete testing coverage and the clinical implications of undiagnosed HIV infection, routine pretreatment HIV screening should be incorporated into standard viral serology panels.

Keywords: HIV, immune checkpoint inhibitors, screening strategies, seroprevalence, solid tumors.

INTRODUCTION

Immune checkpoint inhibitors (ICIs) are a foundational class of therapies that prolong survival in patients with various solid tumors. The modulation of immune responses by ICIs increases the clinical significance of underlying viral infections. HIV infection represents a distinct clinical consideration because of its immunosuppressive effects and its potential to modify the toxicity profile associated with immunotherapy. Targeting the PD-1/PD-L1 axis may also enhance HIV-specific T-cell responses and affect the latent viral reservoir.[1] Combination antiretroviral therapy (ART) has transformed HIV infection into a chronically manageable condition. However, people living with HIV (PLWH), whose life expectancy has increased, remain at elevated risk of both AIDS-defining and non-AIDS-defining malignancies. Large cohort studies indicate that approximately 9% of HIV-positive individuals develop cancer.[2,3] Many studies examining HIV prevalence among patients with cancer include only those with a known HIV diagnosis. Consequently, these studies may underestimate the actual prevalence.[4]

The World Health Organization (WHO) and European guidelines classify specific malignancies and conditions requiring immunosuppressive therapy as "indicator conditions" for HIV testing and recommend routine testing in these settings.[5–7] In healthcare centers without systematic screening programs, undiagnosed HIV infections are more likely to remain undetected.

Although the prevalence of HIV among adults in Türkiye is relatively low, at approximately 0.1–0.2%, according to national and international surveillance reports,[8–11] patients receiving systemic anticancer therapy are more susceptible to infections because of treatment-related and disease-related immunosuppression. National epidemiological studies and temporal trend analyses consistently indicate that HIV prevalence in Türkiye remains low in the general population compared with global averages.[9,12] Establishing baseline HIV status in patients scheduled to receive immunotherapy is critical for effective toxicity management and informed clinical decision-making. This study aimed to determine the seroprevalence of HIV among patients with cancer receiving immunotherapy and to compare the findings with national prevalence data, thereby highlighting the importance of incorporating HIV testing into routine pre-immunotherapy assessments. In addition, we aimed to evaluate the rate of HIV testing in routine clinical practice before or during ICI therapy.

METHODS

This retrospective, single-center observational study was conducted at the Department of Medical Oncology, Faculty of Medicine, Ege University, a tertiary referral center. Adult patients (≥18 years) with histologically confirmed solid tumors who received at least one cycle of ICI therapy, including anti–PD-(L)1 and/or CTLA-4 inhibitors, between January 2015 and July 2025 were included. Demographic characteristics, tumor type, disease stage at ICI initiation, treatment details, comorbidity status, and viral serology results were retrospectively collected from electronic medical records and institutional databases.

KEY MESSAGES

- HIV seroprevalence among cancer patients treated with ICIs was 0.28%, with one confirmed HIV-positive case among 354 tested patients.
- HIV testing results were available for only 60% of patients, and testing was associated with younger age, the presence of comorbidities, and tumor type.
- Routine HIV testing should be incorporated into standard viral screening panels before immunotherapy.

The study protocol was approved by Ege University Medical Research Ethics Committee (Approval Number: 26-2T/58, Date: 05.02.2026). Given the retrospective design and the use of anonymized data, the requirement for informed consent was waived. The study was conducted in accordance with the Declaration of Helsinki.

HIV seroprevalence was assessed only among patients with available anti-HIV test results from the institutional viral serology panel. The viral serology panel included HBsAg, anti-HBs, anti-HBc IgG, anti-HCV, and anti-HIV, and testing was performed using routine standardized laboratory assays. Reactive anti-HIV screening results were verified by Western blot, and HIV positivity was defined based on confirmatory testing.

A total of 590 patients treated with ICIs were identified. Of these, 354 patients (60%) had available viral serology results and were included in the HIV seroprevalence analysis. Patients with and without available HIV test results were compared to evaluate potential selection bias associated with incomplete testing. For comparative and regression analyses, disease stage was categorized as stages I–III or stage IV. Tumor types were grouped as lung cancer, genitourinary tumors, melanoma, and other tumors. Comorbidity status was categorized as present or absent according to documentation in the electronic medical records.

Statistical analyses were performed using IBM SPSS Statistics, version 27.0 (IBM Corp., Armonk, NY, USA). Continuous variables were summarized as the median (interquartile range [IQR]), and categorical variables were summarized as numbers

Table 1. Comparison of patients with and without HIV testing

Variable	Subgroup	HIV Testing performed (n=354)	HIV testing not performed (n=236)	p
Age, years	Median (IQR)	61.3 (22.0)	67.3 (16.7)	<0.001
Sex	Male	233 (65.8)	156 (66.1)	0.891
	Female	121 (34.2)	80 (33.9)	
Comorbidity	Present	167 (47.2)	82 (34.7)	0.003
	Absent	187 (52.8)	154 (65.3)	
Disease stage	Stage I–III	158 (44.6)	105 (44.5)	0.991
	Stage IV	196 (55.4)	131 (55.5)	
Tumor type	Lung cancer	79 (22.3)	48 (20.3)	0.037
	Genitourinary tumors	79 (22.3)	77 (32.6)	
	Melanoma	139 (39.3)	82 (34.7)	
	Other tumors	57 (16.1)	29 (12.3)	

Data are presented as the median (IQR) or n (%). P values were calculated using the Mann–Whitney U test for continuous variables and the χ^2 test or Fisher's exact test for categorical variables, as appropriate. IQR: Interquartile range.

and percentages. HIV seroprevalence was calculated as point prevalence with exact 95% confidence intervals (CIs) using the Clopper–Pearson method. The observed seroprevalence was descriptively compared with the reported national adult HIV prevalence estimates in Türkiye (0.1–0.2%).[11] To identify factors associated with the availability of HIV testing, univariable logistic regression analyses were initially performed. Variables with p<0.20 in the univariable analyses were subsequently included in the multivariable logistic regression model. Results were reported as odds ratios (ORs) with 95% CIs. Tumor type was analyzed as a categorical variable, with the "other tumors" group serving as the reference category. A two-sided p<0.05 was considered statistically significant.

RESULTS

Baseline Characteristics and Treatment Exposure of the Study Cohort

A total of 590 patients treated with immunotherapy were included. The median age was 65 years (IQR, 55–73 years), and 389 patients (65.9%) were male. Melanoma was the most common diagnostic group (37.4%), followed by genitourinary tumors (26.4%) and lung cancer (21.5%). At the initiation of immunotherapy, 327 patients (55.4%) had stage IV disease, whereas 263 patients (44.6%) had stage I–III disease. Regarding treatment exposure, nivolumab was the most frequently administered agent (72.5%), followed by pembrolizumab (15.3%) and atezolizumab (5.1%).

Baseline characteristics according to the availability of HIV testing are presented in Table 1. Patients who underwent HIV testing were significantly younger than those who did not undergo testing (median age, 61.3 vs 67.3 years; p<0.001). Patients with comorbidities were also more likely to undergo HIV testing (47.2% vs 34.7%; p=0.003). No significant differences were observed with respect to sex or disease stage. The distribution of tumor types differed significantly between the groups (p=0.037), with genitourinary tumors being more common among patients who did not undergo HIV testing.

Availability of Viral Serology and HIV Seroprevalence

Among the 590 patients included in the study, viral serology results were available for 354 patients (60%), whereas no serological data were available for 236 patients (40%). Therefore, the HIV seroprevalence analysis was performed exclusively among the 354 patients with available viral serology results.

Of the 354 patients who underwent anti-HIV testing, only one had confirmed HIV positivity. This patient had advanced-stage melanoma and no concomitant HBV or HCV infection. Accordingly, the HIV seroprevalence was 0.28% (1/354), with an exact 95% confidence interval of 0.007–1.56% based on the Clopper–Pearson method. The observed point estimate of 0.28% was numerically similar to the reported national adult HIV prevalence estimates in Türkiye of 0.1–0.2% (Fig. 1).[11,13]

HBV and HCV serology results were also evaluated as part of the institutional viral screening panel. Among the 354 patients with available viral serology results, HBsAg positivity was detected in 14 patients (4.0%), whereas no patients had anti-HCV positivity. Anti-HBs positivity was observed in 154 patients (43.5%). Serological evidence of resolved HBV infection with acquired immunity, defined as concomitant anti-HBc IgG and anti-HBs positivity, was present in 57 patients (16.1%). Vaccine-induced immunity, defined as isolated anti-

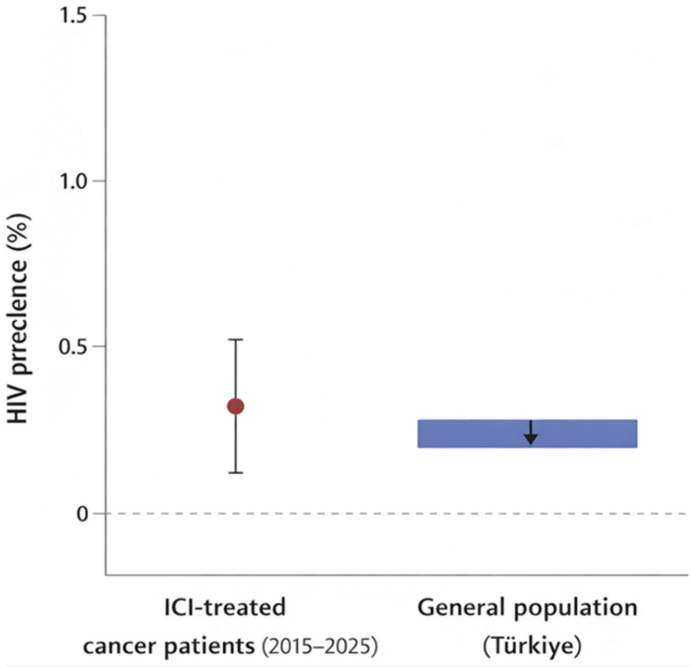

Figure 1. Comparison of HIV prevalence between cancer patients treated with ICIs and the general adult population in Türkiye. The point estimate of HIV prevalence among cancer patients treated with ICIs is presented with the exact 95% confidence interval calculated using the Clopper–Pearson method and compared with the estimated HIV prevalence range in the general adult population in Türkiye (0.1–0.2%).

HBs positivity, was observed in 97 patients (27.4%). Isolated anti-HBc IgG positivity was detected in 32 patients (9.0%). These viral serology results are summarized in Table 2.

Factors Associated With HIV Testing Availability

To further evaluate potential selection bias resulting from incomplete testing, univariable and multivariable logistic regression analyses were performed to identify factors associated with the availability of HIV testing. In the univariable analyses, younger age (OR, 0.972; 95% CI, 0.960–0.985; p<0.001), the presence of comorbidities (OR, 1.666; 95% CI, 1.186–2.341; p=0.003), and tumor type (overall p=0.038) were significantly associated with HIV testing. Sex (OR, 0.972; 95% CI, 0.650–1.453; p=0.891) and disease stage (OR, 1.002; 95% CI, 0.719–1.396; p=0.991) were not associated with testing practices.

Variables with p<0.20 in the univariable analyses were subsequently included in the multivariable logistic regression model. In the multivariable analysis, younger age remained independently associated with a higher likelihood of HIV testing (OR, 0.966; 95% CI, 0.953–0.980; p<0.001). Patients with comorbidities were also more likely to undergo HIV testing (OR, 1.908; 95% CI, 1.338–2.723; p<0.001). Tumor type remained independently associated with testing practices (overall p=0.011). Compared with the reference group of other tumor types, patients with genitourinary tumors were significantly less likely to undergo HIV testing (OR, 0.434; 95% CI, 0.244–0.772; p=0.005), whereas no significant differences were observed for patients with lung cancer (OR, 0.857; 95% CI, 0.470–1.562; p=0.614) or melanoma (OR, 0.616; 95% CI, 0.349–1.088; p=0.095) (Table 3).

Table 2. Viral serology results among patients with an available screening panel

Viral marker or serologic pattern	n (%)
Confirmed anti-HIV positivity	1 (0.28)
HBsAg positivity	14 (4.0)
Anti-HCV positivity	0 (0)
Anti-HBs positivity	154 (43.5)
Anti-HBc IgG and anti-HBs positivity	57 (16.1)
Isolated anti-HBs positivity	97 (27.4)
Isolated anti-HBc IgG positivity	32 (9.0)

Percentages were calculated among the 354 patients with available viral serology results. HIV positivity was defined only on the basis of confirmed positive results. Isolated anti-HBs positivity was considered consistent with vaccine-induced immunity, whereas concomitant anti-HBc IgG and anti-HBs positivity was considered consistent with resolved HBV infection and acquired immunity.

DISCUSSION

In this cohort, the HIV seroprevalence among patients receiving immunotherapy was 0.28%, which was numerically similar to national adult HIV prevalence estimates in Türkiye.[8,11] However, this comparison should be interpreted cautiously because the national estimates were surveillance-based, whereas our data were derived from a hospital-based oncology cohort with incomplete testing coverage. HIV testing results were available for only 60% of patients, and testing was associated with younger age, the presence of comorbidities, and tumor type, suggesting that screening appeared to be influenced by clinical practice patterns rather than being applied systematically. Therefore, the true HIV prevalence may have been underestimated. Nevertheless, the observed prevalence remained above the commonly cited threshold of 0.1% used to support routine HIV screening, underscoring the need for standardized pre-immunotherapy viral screening protocols.

The literature indicates that HIV prevalence in oncology populations is often underestimated.[14] Delayed diagnosis and the lack of routine screening in many centers contribute to this underestimation.[15] Previous studies from low- and middle-income countries have reported HIV prevalence rates of 2–10%

Table 3. Univariable and multivariable logistic regression analyses of factors associated with HIV testing availability

Variable	Univariable OR (95% CI)	p	Multivariable OR (95% CI)	p
Age, per 1-year increase	0.972 (0.960–0.985)	<0.001	0.966 (0.953–0.980)	<0.001
Male sex vs female sex	0.972 (0.650–1.453)	0.891	—	—
Stage IV disease vs stage I–III disease	1.002 (0.719–1.396)	0.991	—	—
Comorbidity present vs absent	1.666 (1.186–2.341)	0.003	1.908 (1.338–2.723)	<0.001
Tumor type, overall	—	0.038	—	0.011
Lung cancer vs other tumors	0.808 (0.454–1.440)	0.470	0.857 (0.470–1.562)	0.614
Genitourinary tumors vs other tumors	0.504 (0.291–0.874)	0.015	0.434 (0.244–0.772)	0.005
Melanoma vs other tumors	0.833 (0.491–1.412)	0.497	0.616 (0.349–1.088)	0.095

Variables with p<0.20 in the univariable analyses were included in the multivariable model. Age was analyzed as a continuous variable. Sex, disease stage, and comorbidity were coded as male versus female, stage IV versus stage I–III, and present versus absent, respectively. Tumor type was analyzed using other tumors as the reference category. CI: Confidence interval; OR: Odds ratio.

among patients with cancer, suggesting that HIV may be underrecognized in oncology populations.[16,17] Evidence from Asian countries also suggests that inadequate HIV screening practices and the absence of routine testing recommendations may contribute to the underdiagnosis of HIV among patients with cancer.[18,19] Consequently, undiagnosed HIV infections may persist in regions where screening strategies are inadequate. Similarly, studies from Europe and North America have shown that HIV testing rates remain suboptimal in oncology practice despite clinically relevant HIV prevalence among tested patients.[20–22] In one large cancer center cohort, HIV prevalence was 1.2% among patients tested before systemic therapy, exceeding the commonly cited threshold of 0.1% for routine screening.[22] These findings suggest that inadequate testing practices, rather than patient refusal alone, may contribute to the underdiagnosis of HIV in oncology populations.[4]

Historically, PLWH were systematically excluded from clinical trials evaluating ICIs. In numerous phase I–III studies, PLWH were either excluded entirely or conditionally included only if they met stringent criteria, such as an HIV RNA level below 50 copies/mL and a $CD4^+$ T-lymphocyte count above 200 cells/mm^3.[23] This exclusion substantially limited the available evidence regarding the use of immunotherapy in HIV-positive populations.

More recently, the growing availability of real-world data has begun to address these limitations. Puronen et al.[1] reviewed evidence indicating that PD-1/PD-L1 inhibitors demonstrate the expected antitumor efficacy in HIV-positive patients, particularly those with melanoma, lung cancer, and Hodgkin lymphoma, with an immune-related adverse event (irAE) profile similar to that observed in HIV-negative populations. Accumulating evidence, including multicenter studies, systematic reviews, and retrospective series, indicates that ICIs can be administered safely to patients with well-controlled HIV infection without adversely affecting $CD4^+$ T-lymphocyte counts, viral load, or other immunological parameters and with clinical outcomes broadly comparable to those observed in HIV-negative patients.[24–27] Therefore, well-controlled HIV infection should not be considered a contraindication to immunotherapy. Rather, the key clinical issue is the early identification of HIV infection before ICI initiation to facilitate appropriate infectious disease assessment, ART optimization, and multidisciplinary management.

ICIs function as potent immune activators and can induce autoimmune toxicities. In individuals with HIV infection, chronic immune dysfunction and latent infections may complicate the clinical presentation of these toxicities. In particular, in cases of undiagnosed HIV infection, distinguishing immune-related adverse events from opportunistic infections may be challenging. Consequently, determining HIV status before initiating immunotherapy is essential for accurately assessing potential toxicities and planning timely infection management.

For patients with confirmed HIV infection, current evidence suggests that concurrent ART and immunotherapy are generally safe. However, infectious disease and oncology teams should collaborate before treatment initiation, taking into account the $CD4^+$ T-lymphocyte count, viral load, comorbidities, and the need for prophylactic measures.[28] Current European and UK guidelines emphasize that HIV testing based solely on high-risk behavior is insufficient and recommend routine testing in patients with HIV indicator conditions, particularly in settings where the expected HIV prevalence exceeds 0.1%.[29–31]

Indicator condition–based testing strategies, including those evaluated in PROTEST and similar studies, have been shown to increase diagnostic yield and may be cost-effective; however, their implementation remains inconsistent.[32–34] These findings support systematic HIV assessment in oncology practice, particularly before chemotherapy or immunotherapy.

Several limitations should be considered. First, because of the retrospective design, HIV testing was not performed systematically, and anti-HIV results were available for only 60% of the cohort, raising concerns about selection bias and the potential underestimation of the true HIV prevalence. Although we performed additional comparative and multivariable analyses to identify factors associated with HIV testing, residual selection bias cannot be excluded. Second, the single-center design limits the generalizability of the findings to the broader oncology population in Türkiye. Third, the small number of HIV-positive cases precluded subgroup analyses of the safety and efficacy of ICIs in people living with HIV. The study was also underpowered to detect small differences relative to the population prevalence. Despite these limitations, this study provides the first large single-center experience from Türkiye evaluating HIV seroprevalence among cancer patients treated with ICIs and comparing it with national population estimates.

CONCLUSION

This study presents the first large single-center cohort from Türkiye evaluating HIV seroprevalence among cancer patients treated with ICIs and comparing it with national population estimates. HIV seroprevalence in this cohort was low at 0.28%. Although the point estimate was numerically similar to national adult prevalence estimates, the wide confidence interval, reflecting the small number of positive cases, precludes firm conclusions regarding comparability at the population level. Notably, the observed prevalence exceeded the commonly cited screening threshold of 0.1%. Given the potential clinical consequences of undiagnosed HIV infection during immunotherapy, these findings support incorporating HIV testing into routine pre-immunotherapy viral serology panels. Further multicenter studies with systematic testing are needed to better define HIV prevalence and optimize screening strategies in oncology practice.

Ethics Committee Approval: Ethics committee approval was obtained from Ege University Medical Research Ethics Committee (Approval Number: 26-2T/58, Date: 05.02.2026).

Informed Consent: Due to the retrospective design and use of anonymized data, informed consent was waived.

Conflict of Interest: The authors have no conflicts of interest to declare.

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REFERENCES

1. Puronen CE, Ford ES, Uldrick TS. Immunotherapy in People with HIV and Cancer. Front Immunol 2019;10:2060. [CrossRef]
2. Mremi A, Mswima J, Mlay MG, Bartholomew H, Alloyce JP, Mmbaga BT, et al. Cancer spectrum in HIV-infected patients: A zonal hospital experience in Tanzania. Cancer Treat Res Commun 2020;25:100213. [CrossRef]
3. Aydin OA, Gunduz A, Sargin F, Mete B, Karaosmanoglu HK, Sevgi DY, et al.; ACTHIV-IST (Action Against HIV in Istanbul) Study Group. Prevalence and mortality of cancer among people living with HIV and AIDS patients: a large cohort study in Turkey. East Mediterr Health J 2020;26(3):276-82. [CrossRef]
4. Darling KEA, Damas J, Frei AL, Frega S, Meyer ML, Peters S, et al. Quality improvement report: Investigating barriers in HIV testing oncology patients to optimize HIV testing practice. HIV Med 2025;26(12):1920-9. [CrossRef]
5. Jordans CCE, Vasylyev M, Rae C, Jakobsen ML, Vassilenko A, Dauby N, et al.; Guidelines Review Group for the projects: Optimising testing and linkage to care for HIV across Europe (OptTEST by HiE) and the Joint Action on integrating prevention, testing and linkage to care strategies across HIV, viral hepatitis, TB and STIs in Europe (INTEGRATE). National medical specialty guidelines of HIV indicator conditions in Europe lack adequate HIV testing recommendations: a systematic guideline review. Euro Surveill 2022;27(48):2200338. [CrossRef]
6. European Centre for Disease Prevention and Control (ECDC). Public health guidance on HIV, hepatitis B and C testing in the EU/EEA: An integrated approach. https://www.ecdc.europa.eu/sites/default/files/documents/hiv-hep-testing-guidance_0.pdf Accessed July 20, 2026.
7. Kadye T, Jamil MS, Johnson C, Baggaley R, Barr-DiChiara M, Cambiano V. Country uptake of WHO recommendations on differentiated HIV testing services approaches: a global policy review. BMJ Open 2024;14(3):e058098. [CrossRef]
8. Yaylali E, Erdogan ZM, Calisir F, Gokengin D, Korten V, Tabak F, et al. Modeling the future of HIV in Turkey: Cost-effectiveness analysis of improving testing and diagnosis. PLoS One 2023;18(6):e0286254. [CrossRef]

9. Erdinc FS, Dokuzoguz B, Unal S, Komur S, Inkaya AC, Inan D, et al.; Multicentric Hiv Study Group. Temporal Trends in the Epidemiology of HIV in Turkey. Curr HIV Res 2020;18(4):258-66. [CrossRef]
10. European Centre for Disease Prevention and Control (ECDC). HIV/AIDS surveillance in Europe 2020 (2019 data). https://www.ecdc.europa.eu/en/publications-data/hivaids-surveillance-europe-2020-2019-data Accessed July 20, 2026.
11. Kaya N. Analysis of HIV/AIDS Reports in Turkey from Disaster Management Perspective. JIHSAM 2021;7(14):46-52. [CrossRef]
12. Lu Y, Li H, Dong R, Zhang M, Dong X, Yang C, et al. Global and regional disease burden of HIV/AIDS from 1990 to 2021 and projections to 2030. BMC Public Health 2025;25(1):1928. [CrossRef]
13. Gökengin D. HIV Infection in Turkey: How Close Are We to the Target? Klimik Derg 2018;31(1):4-10. Turkish. [CrossRef]
14. Reid E, Suneja G, Ambinder RF, Ard K, Baiocchi R, Barta SK, Carchman E, et al. Cancer in People Living With HIV, Version 1.2018, NCCN Clinical Practice Guidelines in Oncology. J Natl Compr Canc Netw 2018;16(8):986-1017. [CrossRef]
15. Yuan T, Hu Y, Zhou X, Yang L, Wang H, Li L, et al. Incidence and mortality of non-AIDS-defining cancers among people living with HIV: A systematic review and meta-analysis. EClinicalMedicine 2022;52:101613. [CrossRef]
16. Traore B, Bah TS, Traore FA, Sow MS, Diane S, Keita M, et al. The Prevalence of HIV in Cancer Patients at the Surgical Oncology Unit of Donka University Hospital of Conakry (Guinea). J Cancer Epidemiol 2015;2015:387896. [CrossRef]
17. Muturi D, Mwanzi SN, Riunga FM, Shah J, Shah R. HIV Prevalence and Characteristics Among Patients With AIDS-Defining and Non-AIDS-Defining Cancers in a Tertiary Hospital in Kenya. JCO Glob Oncol 2023;9:e2200360. [CrossRef]
18. Wonglhow J, Chaiwiriyawong S, Sunpaweravong P, Sathitruangsak C, Dechaphunkul A. Trends in Cancer Diagnoses Among People Living with HIV: A 20-Year Retrospective Study from a Tertiary Center in Thailand. J Clin Med 2025;15(1):22. [CrossRef]
19. Poblete JB, Villafuerte ARM, Mendoza MJL, Malundo AFG, Lucero JAC, Agoncillo AR, et al. HIV Screening among Patients with Newly Diagnosed Solid and Hematologic Malignancies in a Tertiary Hospital in the Philippines. Acta Med Philipp 2024;58(5):5-9.
20. Coghill AE, Shiels MS, Suneja G, Engels EA. Elevated Cancer-Specific Mortality Among HIV-Infected Patients in the United States. J Clin Oncol 2015;33(21):2376-83. [CrossRef]
21. Vliegenthart-Jongbloed KJ, Vasylyev M, Jordans CCE, Bernardino JI, Nozza S, Psomas CK, et al.; #aware.hiv Europe Project. Systematic Review: Strategies for Improving HIV Testing and Detection Rates in European Hospitals. Microorganisms 2024;12(2):254. [CrossRef]
22. Hwang JP, Granwehr BP, Torres HA, Suarez-Almazor ME, Giordano TP, Barbo AG, et al. HIV Testing in Patients with Cancer at the Initiation of Therapy at a Large US Comprehensive Cancer Center. J Oncol Pract 2015;11(5):384-90. [CrossRef]
23. Castelli V, Lombardi A, Palomba E, Bozzi G, Ungaro R, Alagna L, et al. Immune Checkpoint Inhibitors in People Living with HIV/AIDS: Facts and Controversies. Cells 2021;10(9):2227. [CrossRef]
24. Sahin IH, Kane SR, Brutcher E, Guadagno J, Smith KE, Wu C, et al. Safety and Efficacy of Immune Checkpoint Inhibitors in Patients with Cancer Living With HIV: A Perspective on Recent Progress and Future Needs. JCO Oncol Pract 2020;16(6):319-25. [CrossRef]
25. Alatawi AD, Alaqyl AB, Alalawi RJ, Alqarni RS, Sufyani RA, Alqarni GS, et al. Safety and Efficacy of Immune Checkpoint Inhibitors in Human Immunodeficiency Virus-Associated Cancer: A Systematic Scoping Review. Diseases 2025;13(8):230. [CrossRef]
26. Hetta HF, Alatawi Y, Alanazi FE, Alattar A, Alshaman R, Alshareef H, et al. Evaluating the Safety and Efficacy of PD-1 Inhibitors in HIV Patients Diagnosed with Lung Cancer: A Systematic Review. Pharmaceuticals (Basel) 2025;18(11):1654. [CrossRef]
27. Ostios-Garcia L, Faig J, Leonardi GC, Adeni AE, Subegdjo SJ, Lydon CA, et al. Safety and Efficacy of PD-1 Inhibitors Among HIV-Positive Patients with Non-Small Cell Lung Cancer. J Thorac Oncol 2018;13(7):1037-42. [CrossRef]
28. Luo L, Xu Y, Li T. Immune checkpoint inhibitor therapy for cancer patients infected with HIV: A systematic review. Asia Pac J Clin Oncol 2022;18(2):e17-e22. [CrossRef]
29. Lord E, Stockdale AJ, Malek R, Rae C, Sperle I, Raben D, et al.; British Association of Sexual Health HIV (BASHH)/British HIV Association (BHIVA) guideline review group for the Optimising Testing and Linkage to Care for HIV across Europe (OptTEST) project by HIV in Europeb. Evaluation of HIV testing recommendations in specialty guidelines for the management of HIV indicator conditions. HIV Med 2017;18(4):300-4. [CrossRef]
30. Chadwick DR, Sutherland RK, Raffe S, Pool E, Beadsworth M. British HIV Association guidelines on the management of opportunistic infection in people living with HIV: the clinical management of gastrointestinal opportunistic infections 2020. HIV Med 2020;21 Suppl 5:1-19. [CrossRef]

31. Carter DJ, Kagan D, Storer D, Mulcahy S. Clinician-initiated opt-out HIV testing and the law. Sex Health 2025;22(6):SH25083. [CrossRef]
32. Bogers SJ, Hulstein SH, Schim van der Loeff MF, de Bree GJ, Reiss P, van Bergen JEAM, et al.; HIV Transmission Elimination AMsterdam (H-TEAM) Consortium. Current evidence on the adoption of indicator condition guided testing for HIV in western countries: A systematic review and meta-analysis. EClinicalMedicine 2021;35:100877. [CrossRef]
33. Barbanotti D, Tincati C, Tavelli A, Santoro A, Sala M, Bini T, et al. HIV-Indicator Condition Guided Testing in a Hospital Setting. Life (Basel) 2023;13(4):1014. [CrossRef]
34. Croxford S, Tavoschi L, Sullivan AK, Combs L, Raben D, Delpech V, et al. HIV testing strategies outside of health care settings in the European Union (EU)/European Economic Area (EEA): a systematic review to inform European Centre for Disease Prevention and Control guidance. HIV Med 2020;21(3):142-62. [CrossRef]