

RESEARCH ARTICLE

Editorial Process: Submission:04/11/2025 Acceptance:05/10/2026 Published:24/10/2026

Epidemiology of Kaposi's Sarcoma in Uzbekistan, 2016–2024: Gender-, Age-, and Region-Specific Differences

Malika Solmetova¹, Mirza-Ali Gafur-Akhunov², Alisher Yigitaliyev^{3*}

Abstract

Objective: To describe the epidemiology of Kaposi sarcoma in Uzbekistan from 2016 to 2024. **Methods:** A retrospective descriptive study was conducted using aggregated registry data from the Uzbekistan Ministry of Health. Crude rates (CR) and WHO age-standardized incidence rates (ASR) per 100,000 population were estimated. Data were compared by sex, age, residence (urban/rural), and region using log-linear models and z-tests for statistical significance. **Results:** A total of 351 cases were recorded; males accounted for 75.8% and females for 24.2%. Annual ASRs in men significantly exceeded those in women across all years (e.g., 0.20 vs. 0.08 in 2024, $p < 0.01$). Rural residents comprised 62.4% of the total cases. Significant regional heterogeneity was observed, with rural ASRs significantly higher than urban ASRs in specific regions, such as Bukhara (0.31 rural vs. 0.09 urban, $p = 0.011$) and Kashkadarya (0.25 rural vs. 0.05 urban, $p < 0.001$). The disease was concentrated in older populations, with the highest incidence observed in the 70–74 age group. Conversely, the Republic of Karakalpakstan demonstrated a significant overall downward trend (APC -13.73%, 95% CI -19.99 to -6.99, $p < 0.001$). **Conclusion:** The incidence of Kaposi sarcoma in Uzbekistan remains low but is characterized by a significant male predominance, concentration in older age groups, and marked geographic and urban-rural disparities.

Keywords: Age-standardized rate, Crude rate, Sex, Age, Urban-rural disparity, Geographic regions

Asian Pac J Cancer Prev, 27 (10), 3663-3667

Introduction

Kaposi's sarcoma (KS) is an angioproliferative tumor of vascular origin etiologically linked to human herpesvirus type 8 (HHV-8), also known as KS-associated herpesvirus (KSHV) [1]. Clinically and epidemiologically, KS is classified into four primary variants: classic (typically affecting elderly men of Mediterranean or Eastern European descent), endemic (prevalent in sub-Saharan African countries), epidemic (HIV-associated), and iatrogenic (developing secondary to immunosuppressive therapy, such as in solid organ transplant recipients) [2, 3].

Immunodeficiency plays a critical role in the pathogenesis of the disease. In people living with HIV (PLHIV), the risk of developing epidemic KS is strongly correlated with severe immunosuppression, specifically low CD4⁺ T-cell counts and high viral loads. While the widespread implementation of combination antiretroviral therapy (ART) has significantly reduced the incidence of KS among PLHIV, the risk in this demographic remains substantially higher compared to the general population [2-4].

The global burden of KS is characterized by pronounced geographic heterogeneity. The highest

incidence rates are continuously recorded in sub-Saharan Africa, whereas baseline levels across Europe and Central Asia are generally considered low and stable [5, 7]. Despite this, published descriptive data characterizing the epidemiological landscape of KS in Central Asia remain exceptionally scarce.

To ensure accurate cross-regional and temporal comparisons, age-standardized incidence rates (ASRs) based on the WHO World Standard Population are utilized. This standardized methodology effectively eliminates confounding effects caused by variations in the age structure of different populations [7].

Therefore, the aim of this study is to provide the first comprehensive descriptive overview of the epidemiological features of KS in Uzbekistan from 2016 to 2024. This includes an analysis of national incidence trends, sex and age disparities, urban-rural distributions, and regional geographical heterogeneity.

Materials and Methods

Study Design and Data Sources: This study utilized a retrospective, descriptive epidemiological design analyzing aggregated data from 2016 to 2024. Data were

¹Department of Dermatology, Tashkent State Medical University, Tashkent, Uzbekistan. ²Department of Oncology, Center for Development of Professional Qualifications of Medical Workers, Tashkent, Uzbekistan. ³Department of Urology and Oncology, Fergana Medical Institute of Public Health, Fergana, Uzbekistan. *For Correspondence: ayigitaliyev6622@gmail.com

obtained from official annual statistical forms and the national oncological registry of the Ministry of Health of the Republic of Uzbekistan. This study was exempt from ethical review as it used only anonymized, aggregated registry data. The primary units of analysis were newly diagnosed KS cases, aggregated by year of diagnosis, sex, age group, place of residence (urban versus rural), and administrative region. Because of the lack of integrated national databases, individual-level HIV status and antiretroviral therapy (ART) coverage data were not linked to the oncological registry; thus, stratification of KS cases by HIV status was not possible.

Statistical Measures: We calculated both crude incidence rates (CR) and age-standardized incidence rates (ASR) per 100,000 population. The CR was determined by dividing the annual number of newly registered KS cases by the average mid-year population for that corresponding year. To account for variations in population age structures and allow for accurate cross-regional comparisons, age standardization was performed using the direct method based on the World Health Organization (WHO) World Standard Population weights [6]. Ninety-five percent confidence intervals (95% CIs) for the ASRs were estimated utilizing the Poisson distribution.

Data Analysis: Group comparisons including sex, urban/rural residence, and regional disparities were conducted using the natural logarithms of the incidence rate ratios, with corresponding standard errors estimated. The statistical significance of these differences was evaluated using the z-test. Furthermore, temporal trends in ASRs over the study period were analyzed using log-linear regression models to calculate the annual percent change (APC) alongside their respective 95% CIs. A $p < 0.05$ was considered statistically significant. All analyses were performed on completely aggregated, anonymized datasets containing no personally identifiable information.

Results

National Incidence Trends and Sex Distribution

Between 2016 and 2024, the national incidence rates

of Kaposi's sarcoma (KS) in Uzbekistan remained consistently low. The annual number of reported cases fluctuated modestly, ranging from a minimum of 27 cases in 2018 to a peak of 55 cases in 2019. Correspondingly, both the crude incidence rates (CR) and age-standardized incidence rates (ASR) remained approximately 0.10 per 100,000 population, with transient increases reaching up to 0.20 per 100,000 (Figure 1).

Over the nine-year study period, a total of 351 KS cases were registered. The demographic analysis revealed a pronounced male predominance, with males accounting for 75.8% ($n = 266$) and females for 24.2% ($n = 85$) of the total cohort. This significant sex disparity persisted across all years. The annual ASRs for males consistently and significantly exceeded those for females. For instance, in 2019, the male ASR was 0.30 compared to the female ASR of 0.09; similarly, in 2021, the rates were 0.22 versus 0.01, and in 2024, 0.20 versus 0.08 (all $p < 0.01$) (Table 1).

The structure of cases by gender and aggregated age groups showed a concentration in older individuals: among women, 30.6% were aged 40–59, 38.8% were aged 60–79, 4.7% were aged 80+, and the remaining 25.9% were under 40. Among men, the corresponding proportions were 37.2%, 42.5%, 6.4%, and 13.9%, respectively (Figure 2).

Regional Disparities

The average regional ASRs exhibited marked geographic heterogeneity. The highest incidence rates were recorded in the Bukhara region (0.23 per 100,000), the Republic of Karakalpakstan (0.20), and the Kashkadarya region (0.16). In contrast, the lowest rates were observed in the Navoi (0.07), Andijan (0.09), and Tashkent regions (0.09). Compared to the national average, a statistically significant excess in KS incidence was confirmed in the Bukhara region ($SRR = 1.77$; $p = 0.002$) and the Republic of Karakalpakstan ($SRR = 1.54$; $p = 0.038$). Regional incidence trends (APC) also varied substantially: while the Republic of Karakalpakstan demonstrated a significant decline ($APC = -13.73\%$, $p < 0.001$), the Tashkent region showed a sharp increasing trend ($APC = 31.61\%$, $p < 0.001$) (Table 2).

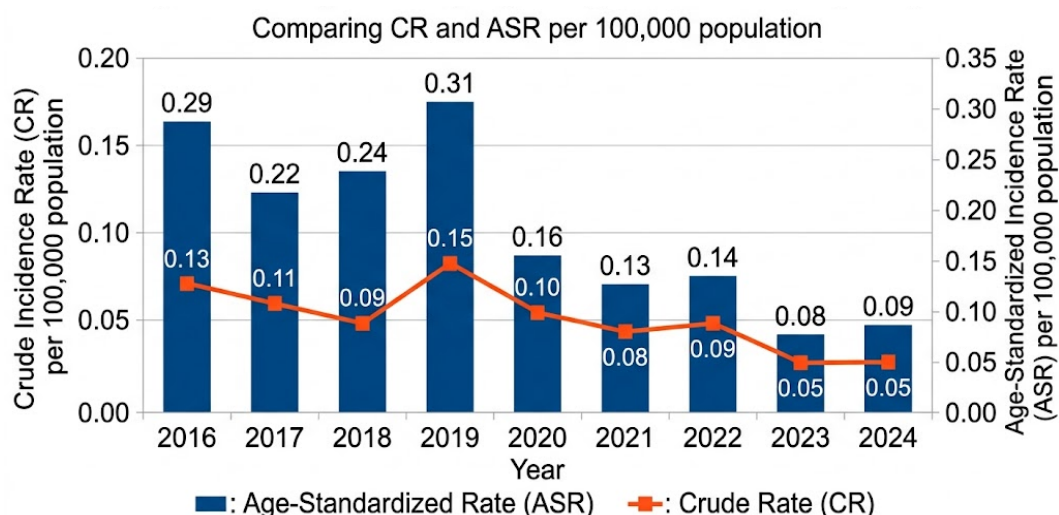


Figure 1. National CR and ASR trends by year, 2016–2024. Source (registry data, Uzbekistan Ministry of Health, 2016–2024)

Table 1. Annual Distribution and Age-Standardized Incidence Rates (ASR) of Kaposi's Sarcoma Cases by Sex in Uzbekistan (2016–2024)

Years	AND , N = 85 ¹	M , N = 266 ¹	F (ASR)	M (ASR)	p -value
2016	8 (24.2 %)	25 (75.8 %)	0.06	0.23	0.003
2017	7 (25.0 %)	21 (75.0 %)	0.05	0.19	0.001
2018	8 (29.6 %)	19 (70.4 %)	0.05	0.16	0.011
2019	13 (23.6 %)	42 (76.4 %)	0.09	0.30	<0.001
2020	7 (21.9 %)	25 (78.1 %)	0.04	0.17	0.002
2021	2 (6.5 %)	29 (93.5 %)	0.01	0.22	<0.001
2022	12 (23.1 %)	40 (76.9 %)	0.06	0.27	<0.001
2023	13 (27.7 %)	34 (72.3 %)	0.07	0.22	<0.001
2024	15 (32.6 %)	31 (67.4 %)	0.08	0.20	0.005

Note: ASR is expressed per 100,000 population based on the WHO World Standard Population. The p-values indicate the statistical significance of the differences between male and female ASRs (calculated via z-test).

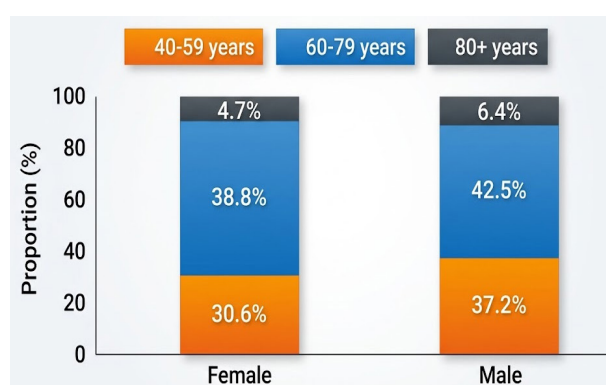


Figure 2. Proportions of Cases by Gender and Aggregated Age Groups. Source (registry data, Uzbekistan Ministry of Health, 2016–2024)

In total, rural residents accounted for the majority of cases (62.4%, $n = 219$), while urban residents comprised 37.6% ($n = 132$). Regional analysis revealed that higher incidence rates were predominantly concentrated in rural

populations. Statistically significant rural excesses were documented in the Bukhara region (0.31 rural vs. 0.09 urban, $p = 0.011$), Kashkadarya region (0.25 rural vs. 0.05 urban, $p < 0.001$), and Surkhandarya region (0.15 rural vs. 0.03 urban, $p = 0.033$). Conversely, an exceptional pattern was observed in the Republic of Karakalpakstan, where the urban ASR (0.26) was higher than the rural ASR (0.14) (Table 3).

Age-Specific Incidence Patterns

The analysis of age-specific crude incidence rates (CR) revealed a clear and significant positive correlation with advancing age, exhibiting a classic epidemiological profile for Kaposi's sarcoma. Throughout the observation period, incidence rates in the pediatric and young adult populations (ages 0–24 years) remained at or near zero, reflecting the extreme rarity of the disease in these demographic cohorts. A gradual increase in incidence was observed starting from the 30–34 age group, subsequently accelerating in the middle-aged and elderly categories.

Table 2. Regional Epidemiological Indicators: Average ASR, Annual Percent Change (APC), and Standardized Rate Ratio (SRR) in Uzbekistan (2016–2024)

Region	Average ASR (WHO)	APC (%/year)	SRR	p-value
Andijan region	0.09	-0.28	0.66	0.076
Bukhara region	0.23	13.72	1.77	0.002
Jizzakh region	0.12	-7.86	0.92	0.797
Kashkadarya region	0.16	13.34	1.27	0.178
Navoi region	0.07	2.06	0.58	0.210
Namangan region	0.11	18.24	0.86	0.520
Republic of Karakalpakstan	0.20	-13.73	1.54	0.038
Samarkand region	0.15	4.97	1.02	0.334
Sirdarya region	0.13	-6.12	1.02	0.973
Surkhandarya region	0.11	-21.55	0.85	0.531
Tashkent region	0.09	31.61	0.68	0.080
Fergana region	0.09	0.37	0.67	0.054
Khorezm region	0.14	-0.71	1.03	0.851
Tashkent City	0.15	15.16	1.19	0.292

Note: ASR is expressed per 100,000 population. SRR, ASR (Region) / ASR (National). The p-value indicates the statistical significance of the SRR (calculated via z-test)

Table 3. Distribution of Kaposi's Sarcoma Cases and Age-Standardized Incidence Rates (ASR) by Urban and Rural Residence Across Regions in Uzbekistan (2016–2024)

Region	Urban, n (%)	Rural, n (%)	Urban ASR	Rural ASR	p-value
Andijan region	7 (33.3%)	14 (66.7%)	0.05	0.12	0.075
Bukhara region	5 (14.3%)	30 (85.7%)	0.09	0.31	0.011
Jizzakh region	4 (36.4%)	7 (63.6%)	0.10	0.14	0.648
Kashkadarya region	7 (17.1%)	34 (82.9%)	0.05	0.25	<0.001
Navoi region	3 (50.0%)	3 (50.0%)	0.06	0.09	0.705
Namangan region	0 (0.0%)	23 (100.0%)	0.00	0.32	NC*
Rep. of Karakalpakstan	17 (60.7%)	11 (39.3%)	0.26	0.14	0.112
Samarkand region	13 (26.5%)	36 (73.5%)	0.11	0.18	0.168
Sirdarya region	2 (33.3%)	4 (66.7%)	0.08	0.17	0.449
Surkhandarya region	2 (10.0%)	18 (90.0%)	0.03	0.15	0.033
Tashkent region	6 (26.1%)	17 (73.9%)	0.06	0.11	0.197
Fergana region	11 (25.0%)	33 (75.0%)	0.08	0.09	0.914
Khorezm region	10 (41.7%)	14 (58.3%)	0.14	0.15	0.913

Note: ASR is expressed per 100,000 population. Total cases n=306 (excluding Tashkent City, as it represents a 100% urban population).

The highest disease burden was consistently identified in the oldest age groups, with incidence peaking significantly in the 70–74 age bracket (reaching 2.58 per 100,000 in 2019) and the 75–79 age bracket (reaching 2.43 per 100,000 in 2022). Furthermore, the 80+ age group demonstrated sustained high rates, fluctuating between 0.32 and 1.36 per 100,000. This upward trend in older age groups underlines the age-dependent nature of Kaposi's sarcoma in the national registry data (Table 4).

Discussion

The national crude and age-standardized incidence rates of Kaposi's sarcoma (KS) in Uzbekistan remained low and stable between 2016 and 2024, aligning with

epidemiological data from Central Asia and Eastern Europe [4, 5]. Our findings confirm a significant male predominance (75.8% of cases), which is a hallmark of KS globally. This sex disparity, particularly pronounced in older age groups, may be influenced by genetic, hormonal, and environmental factors, though further studies are needed to clearly establish these links alongside the established roles of HHV-8 and potential immunosuppression [2, 3].

One of the most striking findings of this study is the marked regional and urban-rural heterogeneity. The significantly higher ASRs observed in rural areas of the Bukhara and Kashkadarya regions (Table 3) may reflect localized variations in HHV-8 seroprevalence or environmental factors that facilitate viral transmission.

Table 4. Age-specific Crude Incidence Rates (CR) of Kaposi's Sarcoma in Uzbekistan by Year (2016–2024)

Age group	2016	2017	2018	2019	2020	2021	2022	2023	2024
0-4	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5-9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10-14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15-19	0.00	0.00	0.04	0.00	0.04	0.00	0.00	0.00	0.00
20-24	0.00	0.00	0.00	0.03	0.03	0.00	0.00	0.00	0.00
25-29	0.00	0.00	0.06	0.03	0.00	0.00	0.03	0.10	0.06
30-34	0.04	0.00	0.03	0.17	0.20	0.06	0.10	0.03	0.03
35-39	0.05	0.04	0.13	0.21	0.08	0.04	0.22	0.11	0.10
40-44	0.06	0.22	0.16	0.16	0.10	0.15	0.10	0.24	0.23
45-49	0.22	0.32	0.11	0.26	0.10	0.15	0.19	0.14	0.14
50-54	0.48	0.07	0.00	0.39	0.19	0.06	0.25	0.19	0.18
55-59	0.28	0.13	0.13	0.32	0.26	0.13	0.38	0.38	0.36
60-64	0.59	0.27	0.38	0.35	0.43	0.80	0.57	0.38	0.45
65-69	0.44	0.41	0.38	0.92	0.32	0.20	0.57	0.76	0.63
70-74	1.88	1.15	1.46	2.58	0.83	0.85	0.99	1.59	0.95
75-79	0.71	1.07	0.00	0.40	0.00	1.63	2.43	0.00	1.16
80+	0.39	0.73	1.06	1.36	0.32	0.45	1.28	1.28	1.23

Note: CR indicates crude incidence rate, expressed as the number of new cases per 100,000 population within each respective age group for each calendar year.

Furthermore, the rural excess could potentially be influenced by delayed healthcare-seeking behavior, leading to cases being identified only when they reach advanced clinical stages. Conversely, the exceptional urban predominance in the Republic of Karakalpakstan (Table 3) likely reflects the centralization of specialized diagnostic oncology services in Nukus, which improves case ascertainment for urban residents compared to those in remote rural districts.

A critical limitation of the current study is the lack of integrated individual-level data regarding HIV status within the national oncological registry. While epidemic (HIV-associated) KS is a major global variant, our analysis was restricted to aggregated data, preventing the direct quantification of the HIV-attributable burden. However, the observed peak incidence in the 70–74 age group (Table 4) suggests a significant contribution of the “classic” (sporadic) variant of KS in Uzbekistan. Nevertheless, the recent sharp increase in incidence in the Tashkent region (APC = 31.61%, $p < 0.001$) warrants further investigation into the potential expansion of HIV-associated cases or improvements in regional reporting accuracy.

To improve national surveillance, it is essential to prioritize the structural linkage of the national cancer registry with HIV/AIDS surveillance databases. Such integration would allow for a more nuanced understanding of the epidemiological shift and the effectiveness of antiretroviral therapy (ART) in reducing KS incidence at the population level.

In conclusion, this study provides the first comprehensive epidemiological analysis of Kaposi's sarcoma (KS) in Uzbekistan, revealing a low but persistent incidence characterized by significant demographic and geographic disparities. Our findings confirm a pronounced male predominance and an age-dependent distribution that peaks in the elderly, consistent with global “classic” KS patterns. The marked regional heterogeneity and urban-rural disparities observed, particularly in the Bukhara and Karakalpakstan regions, highlight the need for targeted surveillance and further investigation into localized HHV-8 seroprevalence.

To improve the national response to this malignancy, we recommend three priority actions: (1) establishing a structural linkage between the national oncological registry and HIV/AIDS surveillance databases to accurately quantify the burden of epidemic KS; (2) conducting regional studies to identify environmental or genetic co-factors contributing to high-incidence clusters; and (3) integrating oncology and infectious disease services to ensure early diagnosis and optimized treatment for high-risk populations. These steps are essential for developing a data-driven national strategy for Kaposi's sarcoma management in Uzbekistan.

Author Contribution Statement

The authors take full responsibility for the clinical data, statistical analysis, and scientific conclusions presented in this study. All epidemiological findings are derived from original registry data as processed by the research team. No AI technologies were utilized for data collection,

statistical processing, or the formulation of the study's conclusions.

Acknowledgements

We are grateful to the data management team of the National Cancer Center of Uzbekistan for their assistance in retrieving and aggregating the registry records for the 2016–2024 period. Their meticulous work was essential for the completion of this epidemiological analysis.

Declaration of Generative AI and AI-assisted technologies in the writing process

During the preparation of this manuscript, the authors used AI-assisted tools strictly for language editing, formatting, and structural refinement of the text. The authors have carefully reviewed and edited the AI-generated suggestions and accept full responsibility for the scientific integrity and accuracy of the final manuscript.

References

1. Chang Y, Cesarman E, Pessin MS, Lee F, Culpepper J, Knowles DM, et al. Identification of herpesvirus-like DNA sequences in AIDS-associated Kaposi's sarcoma. *Science*. 1994;266(5192):1865-9. <https://doi.org/10.1126/science.7997879>.
2. Cesarman E, Damania B, Krown SE, Martin J, Bower M, Whitby D. Kaposi sarcoma. *Nat Rev Dis Primers*. 2019;5(1):9. <https://doi.org/10.1038/s41572-019-0060-9>.
3. Mesri EA, Cesarman E, Boshoff C. Kaposi's sarcoma and its associated herpesvirus. *Nat Rev Cancer*. 2010;10(10):707-19. <https://doi.org/10.1038/nrc2888>.
4. Semeere AS, Busakhala N, Martin JN. Impact of antiretroviral therapy on the incidence of kaposi's sarcoma in resource-rich and resource-limited settings. *Curr Opin Oncol*. 2012;24(5):522-30. <https://doi.org/10.1097/CCO.0b013e328355e14b>.
5. Fu L, Tian T, Wang B, Lu Z, Gao Y, Sun Y, et al. Global patterns and trends in Kaposi sarcoma incidence: a population-based study. *Lancet Glob Health*. 2023;11(10):e1566-e1575. [https://doi.org/10.1016/S2214-109X\(23\)00349-2](https://doi.org/10.1016/S2214-109X(23)00349-2).
6. IARC/WHO. Global Cancer Observatory (GLOBOCAN): Kaposi sarcoma, worldwide statistics. Lyon: IARC; 2024. https://gco.iarc.who.int/today/en/dataviz/pie?mode=population&cancers=19&group_populations=0. [Accessed May 2026].
7. Ahmad OB, Boschi-Pinto C, Lopez AD, Murray CJL, Lozano R, Inoue M. Age standardization of rates: a new WHO standard. GPE Discussion Paper Series No. 31. Geneva: WHO; 2001.



This work is licensed under a Creative Commons Attribution-Non Commercial 4.0 International License.