REVIEW ARTICLE

Racial and Ethnic Disparities in Cancer Care among People with HIV in US: A Systematic Review

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ABSTRACT

Background: People with HIV (PwH) are at heightened cancer risk, but racial/ethnic disparities across the cancer care are not well understood. Our systematic review examined racial/ethnic differences in cancer risk, screening, treatment, and survival/mortality among PwH.

Methods: We searched PubMed, Web of Science, Cochrane Library, ProQuest, and EMBASE for studies published in English (01/01/1980-05/30/2023), using key words and MeSH terms "race/ethnicity", "cancer", and "HIV". Paired reviewers screened studies and extracted data. Study quality was assessed using the National Institutes of Health Study Quality Assessment Tool. All eligible studies were included, regardless of quality, to identify research gaps.

Results: Of the 26 eligible studies, 11 assessed cancer risk only, 4 screening, 5 treatment, and 3 survival/mortality only, while 3 assessed both cancer risk and mortality. Risk studies focused on human papilloma virus-related (4), Kaposi sarcoma (4), urogenital (3), and lung (1) cancers. Among men who have sex with men (MSM), Kaposi sarcoma risk appeared higher among Black men than white, but lower in HHV-8 seropositive MSM. Screening studies on cervical (3), breast (3), and colorectal (2) cancers showed no evidence of disparity. Treatment studies on lymphoma (3) and multiple cancers combined (3) found Black individuals were less likely to receive treatment than their White counterparts. Most studies were rated fair (14) or poor (12).

Conclusions: Our findings suggest that there are racial/ethnic disparities of cancer risk, treatment, and mortality/survival outcomes but no observable disparities related to cancer screening among PwH. Additional research on distinct cancer types to expand the breadth of evidence will address existing gaps in knowledge on racial/ethnic disparities among individuals with PwH at risk or living with cancer.

Contributions to Evidence-Based Practice: Racial/ethnic disparities of cancer risk, treatment, and mortality/survival outcomes but no observable disparities related to cancer screening among PwH. Additional research on distinct cancer types to expand the breadth of evidence will address existing gaps in knowledge to allow for the planning of tailored interventions to provide a more equitable healthcare for individuals at risk or living with cancer in PwH.

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What do we already know about this topic?
People with HIV (PwH) are at risk for AIDS-defining and non-AIDS-defining cancers. Racial/ethnic disparities in the cancer care continuum have been reported in the general US population.
What is the main contribution to Evidence-Based Practice from this article?
This article is a systematic review of epidemiologic evidence on the cancer care continuum (e.g., risk assessment, screening, treatment, and survival/mortality) among PwH in the US stratified by race/ethnicity and cancer type.
What are this research's implications towards health policy?
Our findings suggest that there are racial/ethnic disparities of cancer risk, treatment, and mortality/survival outcomes but no observable disparities related to cancer screening among PwH. Additional research on distinct cancer types to expand the breadth of evidence will address existing gaps in knowledge on racial/ethnic disparities among individuals with PwH at risk or living with cancer.
Authors' Contributions Statement:
S.O.N. made substantial contribution to the design, review, extraction, and interpretation of data; as well as drafting of the manuscript. A.T.W. made substantial contribution to the review, extraction, and interpretation of data. L.E.A. made substantial contribution to the study design. R.L.C made substantial contribution to the critical revision of the manuscript. S.K. made substantial contribution to the updated data search. M.I. made substantial contribution to the initial review and extraction of data.

Introduction

HIV remains a major public health and economic challenge in the US, impacting over 1.2 million people (Centers for Disease Control and Prevention (CDC), 2024). People with HIV (PwH) experience elevated risk of cancer (Biggar et al., 2007; Dunn et al., 2004). HIV weakens the immune system by replicating in CD4 T cells and lymphatic tissue, leading to declining CD4 T cell counts, compromised immunity, and eventually leading to Acquired Immune Deficiency Syndrome (AIDS) (Pacheco et al., 2015). PwH are also at increased risk for both AIDS-defining cancers (ADCs, e.g., Kaposi sarcoma, non-Hodgkin's lymphoma, and cervical cancer) and non-AIDS-defining cancers (NADCs)(CDC, 1993; Chen et al., 2021; Hernández-Ramírez et al., 2017), driven by immunosuppression, chronic inflammation(Biggar et al., 2007), and heightened susceptibility to oncogenic viruses like HPV(Biggar et al., 2007; Sezgin et al., 2018; Smith et al., 2014). Additionally, some cancers may be associated with prolonged ART exposure (Buchacz et al., 2010) and accelerated aging(H. A. Robbins et al., 2014), which can further elevate cancer risk among PwH.

Previous studies show that these AIDS-defining cancers (ADCs) occur at rates three (cervical) to 500 (Kaposi sarcoma) times higher among PwH compared to the general population (Dunn et al., 2004). Several non-AIDS-defining cancers (NADCs), including lung, liver, and anal cancers, are also more common in PwH(Dunn et al., 2004). Cancer is now one of the leading causes of death among PwH, with NADC-related deaths surpassing those from ADCs (Crum-Cianflone et al., 2009; Shiels et al., 2011).

Racial/ethnic disparities in the cancer care continuum have been reported in the general US population(Abuali et al., 2023; Clark et al., 2015; Greenberg et al., 2023; Wagner et al., 2024; Zavala et al., 2021), with particularly Black/African American (hereafter referred to as Black) individuals at higher risk for cancer and poor survival outcomes compared to White individuals(Aizer et al., 2014; R. L. Siegel et al., 2019; Tehranifar et al., 2016; Trickey et al., 2016; Weber et al., 2013). While Black (37% new infections) and Hispanic/Latino (33%) (hereafter referred to as Hispanic ethnicity) individuals are disproportionately impacted by HIV when compared to their White

counterparts (24%)(CDC, 2024; A. S. Robbins et al., 2012) studies on racial/ethnic disparities across the cancer care continuum among PwH are extremely limited. Since HIV itself is a cancer risk factor, it is unclear whether the disparities observed in the general population are mirrored in PwH. Therefore, we conducted a systematic review of epidemiologic evidence on the cancer care continuum (e.g., risk assessment, screening, treatment, and survival/mortality) among PwH in the US stratified by race/ethnicity and cancer type. We also assessed the strengths and limitations of current evidence and identified research gaps to suggest potential areas for future research.

Methods

Data Sources and Searches

We conducted a systematic review on racial/ethnic disparities related to cancer among PwH. Our systematic review conforms to the Preferred Reporting Items for Systematic reviews and Meta-Analysis (PRISMA) guidelines (PRISMA, 2021). We searched the following databases: PubMed (US National Institute of Health [NIH]), Web of Science, Cochrane Library, ProQuest Thesis and Dissertations, and EMBASE. In consultation with a public health research librarian (LEA), a search strategy was developed using combination of terms for cancer, HIV, and population descriptors or race, ethnicity, and other disparity-related terms. We used this comprehensive approach for disparity-related terms to allow for later investigation into other types of disparities relate to cancer among PwH. A detailed list of search terms is provided in Supplemental Table 1. The initial search was completed in June 2020 and were limited to studies conducted between January 1st, 1980, and June 23rd, 2020. An updated database search was later conducted covering the period June 23rd, 2020, to May 30th, 2023.

Study Selection

We retained original research articles conducted in the US that investigated all components of the cancer care continuum, including cancer prevention, screening, treatment, and survival/risk of mortality, among PwH, and concurrently compared at least two racial/ethnic groups (e.g., White, Black, Hispanic) with HIV on any component of the cancer care continuum. We used an inclusive approach to select articles that meet the above inclusion criteria, irrespective of cancer type, study design, and other participant characteristics (e.g., age, gender). Selection was limited to publications accessible in English. We excluded reviews, case studies/case series, and secondary references quantitative/qualitative studies (e.g., opinions and editorials).

Eligible articles were selected through several steps (Figure 1): (1) Records from database searches were screened independently by title and abstract, after removing duplicates by four reviewers (A.W, S.N, L.A, and M.I) working in pairs, (2) Selected studies originally available as abstracts were searched for full-text publications using the title and author names and further evaluated for eligibility in the full-text format by the reviewers. Articles that did not meet the eligibility criteria were excluded (Supplemental Table 2). For published abstracts for which there were no later full-text publications, we searched databases for full-text articles by any of the listed authors with the same or a different title but matching study population and methods. We also retained informative abstracts with tables and/or figures for which we could not find full texts.

We assessed reviewer agreement during the article screening process, finding 95% during

the title/abstract and 55% full-text review. Disagreements were resolved through extensive discussions based on the pre-determined eligibility criteria.

Data Extraction and Synthesis

Data abstraction was conducted by four reviewers (A.W, S.N, L.A, and M.I) working in pairs to ensure accuracy of data extraction and entry. We extracted data on study design, population, cancer type(s), components of the cancer care continuum assessed in the study, racial/ethnic groups being compared, and study results. Because some studies included both individuals with HIV and those without HIV, abstraction of results was limited to those that specifically compared racial/ethnic groups among persons with HIV. We critically reviewed the final selection of studies and summarized findings on racial/ethnic disparities among PwH for the cancer types identified across the spectrum of cancer outcomes.

Heterogeneity of the studies with respect to cancer type, study population, component of cancer care continuum assessed, and presentation of the outcome estimates (e.g., incidence, mortality rate, Odds Ratio [OR]) precluded a direct pooling of the results. Hence, we were unable to conduct a meta-analysis across the studies.

Quality Assessment

The methodological quality of eligible studies was assessed independently by S.N. and A.W. using the National Institutes of Health (NIH) quality assessment tool for observational cohort and cross-sectional studies(National Institutes of Health, 2021.). This tool assesses quality based on 14 items covering clarity of research question, appropriateness of study population recruitment, sample size justification, exposure and outcome measurement, temporality, and timeframe for follow-up, blinding, and control for confounding. The study population was expected to be clearly specified and defined with uniform application of inclusion and exclusion criteria and participation rate of at least 50%. In our study, the exposure was race/ethnicity and was expected to be measured before a well-defined outcome (components of the cancer care continuum, risk, screening, treatment, and survival/mortality risk).

We applied stringent quality ratings, with the overall quality rating based on the totality of identified flaws. We considered adjustment for potential confounders a necessary criterion for “high” study quality. All eligible studies were included, regardless of quality, to identify research gaps in existing literature.

Review, data extraction, and quality assessment were completed on 14 June 2021.

Updated Database Search

The updated database search, covering June 23rd, 2020, to May 30th, 2023, was conducted using the previously developed search strategy. The study selection followed the inclusion and exclusion criteria from Section 2.2. Screening, quality assessment, and data extraction of the newly identified articles were conducted in pairs (S.K. and S.O.N.) following the protocol in Sections 2.3 and 2.4.

Results

A total of 3,224 unique records (published between 1980 to 2020) were screened for eligibility and retained 23 studies(Blair, 1996; Bolanos, 2018; Cachay et al., 2018; Datta et al., 2010; Dutta et al., 2017; Goedert et al., 2007;

Hysell et al., 2019; Lambert, 2013; Marcus et al., 2014; Martin, 2010; Nawar et al., 2005; Olszewski et al., 2016; Olszewski & Castillo, 2016; Ortiz et al., 2018; Rositch et al., 2018; Royse et al., 2017; Salihu et al., 2021; Sigel et al., 2012; Suneja et al., 2014, 2016; Weinstein et al., 2016; White et al., 2019; Hysell et al., 2019; Blair ., 1996; Bolanos., 2018; Chapman., 2013., Correll., 2015., Martin., 2010). The updated search (2020-2023) identified 1,473 new articles, of which 3 additional studies were retained(Cachay et al., 2023; McGee-Avila, 2022; Knights et al., 2022). The study selection flow chart is shown in Figure 1.

Of the 26 studies (published, 1996-2023), 42% (N=11) reported risk estimates by at least two racial/ethnic groups, 12% (N=3) reported both risk and mortality estimates, 12% (N=3) reported only mortality, 19% (N=5) compared treatment receipt by race/ethnicity, and 15% (N=4) focused on cancer screening by race/ethnicity. Table 1 presents the characteristics of eligible studies included in this systematic review. Seventy- three percent (N=19) of these were peer-reviewed manuscripts(Cachay et al., 2018, Cachay et al., 2023; Datta et al., 2010; Dutta et al., 2017; Goedert et al., 2007; Knights et al., 2022; Marcus et al., 2014; Nawar et al., 2005; Olszewski et al., 2016; Olszewski & Castillo, 2016; Ortiz et al., 2018; Rositch et al., 2018; Royse et al., 2017; Salihu et al., 2021; Sigel et al., 2012; Suneja et al., 2014; Weinstein et al., 2016; White et al., 2019), 0.04% (N=1) a peer-reviewed abstract (Hysell et al., 2019), while 23% (N=6) were dissertations(Blair, 1996; Bolanos, 2018; Correll, 2015; JK, 2022; Lambert, 2013; Martin, 2010; McGee-Avila, 2022). Twenty-three percent (N=6) of the studies considered racial/ethnic disparities in cancer outcomes as one of their primary study objectives(Blair, 1996; Datta et al., 2010; Dutta et al., 2017; Ortiz et al., 2018; Royse et al., 2017; Salihu et al., 2021) while the other 76% (N=20) studies considered race/ethnicity as one of several examined demographic factors/covariates associated with cancer outcomes (Bolanos, 2018; Cachay et al., 2018, 2023; Correll, 2015; Goedert et al., 2007; Hysell et al., 2019; JK, 2022; Knights et al., 2022; Lambert, 2013; Marcus et al., 2014; Martin, 2010; Nawar et al., 2005; Olszewski & Castillo, 2016; Rositch et al., 2018; Sigel et al., 2012; Suneja et al., 2014, 2016; Weinstein et al., 2016; White et al., 2019).

PwH were the primary population of interest in 46% (N=12) studies(Blair, 1996; Cachay et al., 2018, 2023; Correll, 2015; Goedert et al., 2007; JK, 2022; Knights et al., 2022; Lambert, 2013; Marcus et al., 2014; Martin, 2010; Nawar et al., 2005; Salihu et al., 2021; Weinstein et al., 2016). They were compared to people without HIV in 43% (N=10) studies (Dutta et al., 2017; Hysell et al., 2019; Marcus et al., 2014; Olszewski et al., 2016; Olszewski & Castillo, 2016; Ortiz et al., 2018; Rositch et al., 2018; Sigel et al., 2012; Suneja et al., 2014, 2016) while only younger MSMs were included in 17% (N=4) studies (Bolanos, 2018; Datta et al., 2010; Royse et al., 2017; White et al., 2019). The 4 studies of younger MSMs examined Kaposi sarcoma (KS) excluded older adults and all women to derive a proxy population with HIV based on the projection over 90% of cases of KS in young men are AIDS-related (Shiels et al., 2011). Most (58%, N=15) of the studies were retrospective cohort studies with databases including Surveillance, Epidemiology, and End Results program (SEER)-Medicare (Cachay et al., 2023; Datta et al., 2010; Rositch et al., 2018; Royse et al., 2017), National Cancer Database (NCDB) (Olszewski et al., 2016; Olszewski & Castillo, 2016; Suneja et al., 2016), Veteran Aging Cohort Study (VACS) (Sigel et al., 2012), HIV/AIDS Cancer Match (HACM) study (Goedert et al., 2007; Ortiz et al., 2018; Suneja et al., 2014), New

Jersey AIDS Cancer Match registry (Martin, 2010), medical records from health plans (Marcus et al., 2014) or single centers (Cachay et al., 2018, 2023; Weinstein et al., 2016). Twenty-two percent (N=5) of the studies were prospective cohort studies based on the Multicenter AIDS Cohort Study (MACS) (Bolanos, 2018; Dutta et al., 2017), the Adult and Adolescent Spectrum of HIV Disease Study (Blair, 1996), the National Cancer Institute's AIDS Cancer Cohort Study (Nawar et al., 2005) or single-center studies (Hysell et al., 2019). Nineteen percent (N=5) of the studies were cross-sectional studies based on data from the National Inpatient Sample (NIS) (Salihu et al., 2021), the Centers for Disease Control and Prevention Wide-ranging Online Data for Epidemiologic Research (CDC WONDER) (White et al., 2019), or from a single or multisite centers (Correll, 2015; Knights et al., 2022; Lambert, 2013). One was a mixed-methods study including retrospective data from the Ryan White program(JK, 2022). Study characteristics are shown in Table 1.

Quality Assessment

Table 2 details the quality rating for studies included in the systematic review. For the four studies on cancer screening, 50% (N=2) were rated fair, 25% (N=1) rated poor, and 25% (N=1) did not have sufficient information to determine the quality (informative abstract). For 11 studies on cancer risk only, 36% (N=4) were rated fair, and 64% (N=7) rated poor. For the five studies on cancer treatment, 80% (N=4) were rated fair and 20% (N=1) poor. All three studies (100%) on cancer mortality only were rated fair. For the three studies on both cancer risk and mortality, 33% (N=1) was rated fair and 67% (N=2) were rated poor. Overall, 14 and 12 of the 26 included studies were rated fair and poor, respectively. None of the 26 studies was rated good. For most of the studies, low ratings were due to non-control for confounders and/or inadequate information on exposure and outcome measurement. In general, the risk of bias of the included studies was high mainly due to low confidence in the quality of exposure and outcome measurement.

Racial/Ethnic Disparities in Cancer Risk

Cancer risk was defined using either incidence, prevalence (proxy for incidence) or relative risk. Fourteen studies (54%) reported on cancer risk(Bolanos, 2018; Cachay et al., 2018, 2023; Dutta et al., 2017; Goedert et al., 2007; JK, 2022; Marcus et al., 2014; Martin, 2010; Nawar et al., 2005; Ortiz et al., 2018; Royse et al., 2017; Salihu et al., 2021; Sigel et al., 2012; White et al., 2019). There were four studies investigating racial/ethnic disparities in the risk of Kaposi sarcoma (KS). Two of these included men who have sex with men (MSM)s and/or bisexual men who were HHV-8 seropositive; these reported 60-75% lower risk of KS among Blacks compared to Whites(Bolanos, 2018; Nawar et al., 2005). The other two studies included men under 55 years, and these found a higher risk of KS among Blacks compared to Whites(Royse et al., 2017; White et al., 2019). One of the two studies also reported higher risk among Hispanics but lower risk among Native American/Alaska Natives and Asian Pacific Islanders compared to Whites. In both studies, the racial/ethnic groups were not compared statistically.

A single study investigated racial/ethnic differences in risk for anal, cervical, vulval, vaginal, penile, oropharyngeal cancers individually with Hispanics as the reference group(Ortiz et al., 2018). Non-Hispanic (NH)-White (Adjusted IRR=0.54, 95% CI=0.46-0.63)

and NH-Black (Adjusted IRR=0.65, 95% CI=0.56-0.77) men had a significantly lower incidence of anal cancer compared to Hispanics. With regards to cervical cancer incidence, NH-White women had a significantly higher incidence than Hispanic women (Adjusted IRR=1.7, 95% CI=1.19-2.43), but there was no significant difference between NH-Black and Hispanic women. Conversely, NH-White (Adjusted IRR=0.4, 95% CI=0.24-0.67) and NH-Black (Adjusted IRR=0.62, 95% CI=0.41-0.95) women both had a significantly lower incidence of vulval cancer compared to Hispanic women. In regard to penile cancer incidence, NH-White men had a significantly higher incidence of penile cancer than Hispanic men (Adjusted IRR=2.6, 95% CI=1.36-4.96). Another study investigated progression of anal intraepithelial neoplasia to invasive cancer and found lower rates of progression to high-grade squamous intraepithelial lesion among Blacks compared to Whites (HR=0.51, 95% CI=0.3-0.88) but no significant difference for further progression to anal cancer among Whites, Blacks, and Hispanics(Cachay et al., 2018). Additionally, one study investigated cervical cancer among hospitalized women with HIV(Salihu et al., 2021). Prevalence was 9.3, 30.9, and 30.2 per 10,0000 among White, Black, and Hispanic women, respectively. No measure of association was reported. Similarly, one study investigated the risk of invasive anal cancer among PwH and the result of the study showed that the odds of anal high-grade squamous intraepithelial lesion (aHSIL) is high among non-Hispanic Blacks compared to non-Hispanic White (Adjusted OR= 0.71, 95% CI= 0.51-0.98)(Cachay et al., 2023).

Two studies investigated racial/ethnic differences in prostate cancer risk(Dutta et al., 2017; Marcus et al., 2014). Both had similar findings of disparities among Blacks compared to non-Blacks (ARR=2.50, 95% CI=1.05-4.20, Adjusted IRR=3.22, 95% CI=1.27-8.16). One study investigated testicular cancer (germ cell tumors) reporting similar standardized incidence ratios for White (1.9) and Black (1.8) men with no statistical comparison conducted(Goedert et al., 2007). We only identified a single study that investigated the incidence of lung cancer. In this study, although it reported that lung cancer cases were more likely among Whites with HIV compared to other racial/ethnic groups, the results of the adjusted regression model included both persons with and without HIV, thus precluding statistical comparisons(Sigel et al., 2012). Another study investigated trends in any cancer incidence. In the adjusted model that included covariates, non-Blacks had a longer time to cancer diagnosis compared to Blacks (AHR=1.23, 95% CI=1.05-1.45)(Martin, 2010).

Racial/Ethnic Disparities in Cancer Screening

Of the 26 studies, four investigated cancer screening(Correll, 2015; Hysell et al., 2019; Lambert, 2013; Weinstein et al., 2016). The four studies, including one from the updated review, investigated racial/ethnic differences in cervical cancer screening among women with HIV. One study found that the cervical cancer screening rate was significantly lower for White women with HIV (40%) compared to Asian (48%), Black (52%), Hispanic (53%), and other women (61%) with HIV(Hysell et al., 2019). The second study was cross-sectional and found no significant difference either by racial identity or by Hispanic identity(Correll, 2015). For the third study, there was no significant association in race/ethnicity when confounding factors were accounted for and race/ethnicity was excluded from the adjusted model by backward elimination(Lambert, 2013). Similarly, the fourth

study found no significant difference in race/ethnicity with receipt of Papanicolaou test(Weinstein et al., 2016).

Three studies investigated differences in breast cancer screening (Bolanos, 2018; Hysell et al., 2019; Weinstein et al., 2016). All three studies found no association between race/ethnicity and breast cancer screening among women with HIV. Two studies investigated racial/ethnic differences related to colorectal cancer screening(Correll, 2015; Weinstein et al., 2016) . While one study found no significant difference across racial/ethnic groups(Hysell et al., 2019), the other study had a limited sample size to compare race differences (N Black =35 vs. N White =1)(Correll, 2015). Among the 35 Black women with HIV included in the latter study, only 17.1% completed colorectal cancer screening per U.S. Preventive Services Task Force (USPSTF) recommendations while the single White woman included did not complete screening. Of note, none of the identified studies examined lung or prostate cancer screening.

Racial/Ethnic Disparities in Cancer Treatment

Five of the 26 included studies compared cancer treatment across racial/ethnic groups. Olszewski et al. investigated racial/ethnic differences in treatment for Hodgkin's(Olszewski & Castillo, 2016) and non-Hodgkin's lymphoma(Olszewski et al., 2016) in two separate studies but using the same data source (NCDB 2004-2012). For Hodgkin's lymphoma, Blacks (AOR=1.67, 95% CI=1.24-2.27) and Asians/other racial groups (AOR=3.69, 95% CI=1.54-8.86) respectively had 67% and 269% higher odds of not receiving chemotherapy compared to Whites; with no significant difference between Whites and Hispanics. For non-Hodgkin's lymphoma, Blacks had 41% higher odds of not receiving chemotherapy compared to Whites (AOR=1.41, 95% CI=1.18-1.68)(Olszewski et al., 2016). There was no significant difference between Whites and Hispanics, Asians, or other racial groups.
The other three studies investigating racial/ethnic differences in cancer treatment reported on multiple cancers combined(Rositch et al., 2018; Suneja et al., 2014; Suneja et al., 2016). Two studies had similar findings of disparities for Blacks when compared to Whites with 42% higher odds of Blacks not receiving treatment for either solid tumors (AOR=1.42, 95% CI=1.16-1.73) and lymphomas (AOR=1.42, 95% CI=1.2-1.67) and 27% higher odds of Whites receiving treatment compared to Blacks (OR=1.27, 95% CI=1.01-1.6)(Suneja et al., 2014; Suneja et al., 2016). In both studies, there was no significant difference in receipt of treatment between Whites and Hispanics. The third study found no significant difference in receipt of treatment across racial/ethnic groups(Rositch et al., 2018).

Racial/Ethnic Disparities in Mortality

Six out of 26 studies compared cancer mortality across racial/ethnic groups(Blair, 1996; Datta et al., 2010; Knights et al., 2022; Ortiz et al., 2018; Royse et al., 2017; Salihu et al., 2021). The cancers examined were all virus-associated – Kaposi sarcoma, cervical, anal, vulval, and penile cancers. Four studies, including one from the updated review, examined Kaposi sarcoma. Two of these were based on SEER-Medicare data and found significantly higher mortality among Blacks compared to Whites in terms of all-cause mortality, Kaposi sarcoma-specific mortality, and median survival time(Datta et al., 2010; Royse et al., 2017). One of the two studies conducted stratified analysis by HAART era and

cancer stage(Datta et al., 2010). The White-Black disparity remained consistent across all cancer stages (T0, T1, and TUK) in the 1995-2004 time period. The third study was a smaller prospective study (N=321) and did not find a significant difference in mortality or median survival between Whites and Blacks or Hispanics(Blair, 1996). Similarly, the fourth study was a retrospective study including patients with HIV-associated Kaposi's Sarcoma. The result of the study showed that Black patients had higher mortality compared to White or Hispanic patients (HR= 2.07, 95% CI= 1.12–3.82) (Knights et al., 2022).
Two studies investigated mortality outcomes related to cervical cancer. One of the studies was based on National Inpatient Sample data with in-hospital mortality 3.5 and 1.5 times higher among Blacks compared to Whites and Hispanics, respectively(Salihu et al., 2021). The second study was a cohort study and found no significant difference in 5-year survival among Hispanics compared to Whites and Blacks(Ortiz et al., 2018). This study also investigated anal, vulval, penile cancers. Mortality related to anal cancer was 48% lower among Hispanic women with HIV compared to Black women (AHR=0.52, 95% CI=0.34-0.80) with no significant difference between Hispanics and Whites. There was also no association between racial/ethnic groups for anal cancer (men), penile cancer, and vulval cancer.

Discussion

Cancer has emerged as a leading cause of morbidity and mortality among people with HIV. In our systematic review, we examined racial/ethnic disparities in cancer risk, screening, treatment, and mortality among people with HIV. Overall, there was no evidence for disparities in cancer screening among PwH. For cancer risk, Hispanics appeared to have a higher risk of anal (men only) and vulval cancer but a lower risk of penile and cervical cancer relative to Whites, while Blacks had a higher risk of prostate cancer. However, observed disparities in Kaposi sarcoma risk were mixed. For cancer treatment, Blacks were consistently less likely to receive treatment. For mortality, KS-related mortality appeared to be higher for Blacks. For HPV-associated cancers, the only disparity signal identified was higher mortality for Blacks compared to Hispanics among those with comorbid HIV and anal cancer. To our knowledge, this is the first systematic review to evaluate racial/ethnic disparities in any cancer outcome among PwH in the US.

Overall, we found that studies on Kaposi sarcoma risk reported higher incidence/prevalence of KS among Black MSMs with HIV relative to White MSMs, while higher incidence/prevalence was reported among White MSMs in studies that restricted the study population to MSMs with HIV infection and HHV-8 seropositivity. KS is an AIDS-defining cancer caused by the HHV-8 herpes virus(Chang et al., 1994) whose expression is promoted by inflammation and immunosuppression due to coinfection with HIV(Hengge et al., 2002). In the US, HHV-8 seropositivity is more prevalent among Whites with HIV compared to Blacks(Labo et al., 2015). Although HHV-8 seropositivity and being White are risk factors for KS risk among PwH(Labo et al., 2015), it appears that the differences observed between the sets of studies might be explained by trends rather than restriction by HHV-8 seropositivity. Recent trend studies indicate that KS incidence declined with the introduction of highly active antiretroviral therapy (HAART) with sharper decline among Whites relative to Blacks and KS-related Black-White survival disparity gap

widening(Kumar et al., 2019). The two studies on KS risk included in our review which did not restrict MSMs by HHV-8 seropositivity were based on data collected on or after 2000. On the other hand, the two studies with this restriction included data collected earlier than 2000 either partially or completely with one based on 1997 to 2000 data. This suggests that the impact of the transition to HAART use on KS incidence was not immediate. Furthermore, there may also be inequity in HAART uptake between Blacks and Whites. A similar temporal trend was observed for the studies on KS mortality with a tendency towards no evidence of disparity for data collected before the mid-1990s and high mortality for Blacks for data collected after. Further investigation is needed to delineate the current contributions of HHV-8 seropositivity and HAART use in Black-White disparities related to KS risk and mortality among PwH.

Studies on prostate cancer risk reported higher incidence for Blacks with HIV compared to Whites. Such findings have also been observed in the general population with genetics playing an important role in the elevated risk observed among Blacks. Blacks are 1.7 times more likely than Whites to be diagnosed with prostate cancer and African ancestry is an important predictor of risk(American Cancer Society, 2022; Conti et al., 2021). In our study of people with HIV, the Black-non-Black incidence rate ratios ranged from 2.5-3.2, a disparity gap almost twice that observed between Blacks and Whites in the general population(Dutta et al., 2017; Marcus et al., 2014). Although other groups have a lower risk of prostate cancer than Whites and Blacks in the general population, their exclusion from the Black-White comparison does not account for the wider gap observed within the HIV population given the relatively smaller population size of the other groups(Siegel et al., 2020). There is a likely interaction between the mechanisms by which African ancestry contributes to tumorigenesis in the prostate and HIV infection. A better understanding of the interactive processes at play at the pathophysiological level is required.
Four of the five studies on treatment reported a lower likelihood of Blacks with HIV receiving cancer treatment compared to Whites. This trend has also been observed in the general population(Bui et al., 2021; Cho et al., 2021; Fang et al., 2018; Patel et al., 2022; Savitch et al., 2022). Some explanatory factors for this trend are the lower socioeconomic status and poorer or lower quality access to care experienced by Blacks relative to Whites(Annesi et al., 2022; Freedman et al., 2013; Wheeler et al., 2012). However, health-system factors also play a role as it has been shown that high-income Blacks diagnosed with cancer and those who have access to a surgeon are still less likely than their White counterparts to receive cancer care(Emerson et al., 2020; Ezer et al., 2020). This may be attributed to medical mistrust and poor patient-provider communication stemming from centuries of medical experimentation on Blacks(Lin et al., 2014; Pollack et al., 2017). Further, cancer treatment for a person with HIV is complicated, given the additional considerations for frailty from advanced HIV, drug-drug interactions, and adverse effects of oncologic treatment(Suneja et al., 2015). Therefore, interventions that aim to reduce disparities in cancer treatment for Black people with HIV should target patient-provider interactions addressing potential issues of mistrust and challenges of communicating a treatment plan that accounts for their comorbidity.

The summation of evidence on cancer-related

disparities among PwH remains incomplete. We identified a few studies for each combination of cancer type and outcome with a maximum of four studies on KS risk. The heterogeneity of identified studies and lack of point and variance estimates in some of the studies further limited the comparability and pooling of findings. For example, although four studies examined disparities in KS risk(Bolanos, 2018; Nawar et al., 2005; Royse et al., 2017; White et al., 2019), two of the studies were restricted to those with HHV-8 seropositivity(Bolanos, 2018; Nawar et al., 2005) while only one study reported a complete measure of association (relative risk with 95% confidence intervals)(Nawar et al., 2005). Additionally, the quality of the studies was generally poor with none of the identified studies rated as good. This review identifies potential targets for further investigation, including the possibility of effect modification by HHV-8 seropositivity on disparities in KS risk among PwH. It also points to a current sparsity of evidence on racial/ethnic disparities related to cancer among PwH despite abundant evidence on cancer being important comorbidity in this population, making this area of inquiry available for further exploration.

Despite the recent public attention on racial/ethnic disparities, discrimination, systemic racism, there is still much to learn about racial/ethnic disparities within the cancer care continuum and among PwH. For instance, given the limited number of studies investigating racial/ethnic disparities in relation to cancer outcomes of PwH, we chose to be more inclusive of selected studies in order to identify and critically review research relevant to the subject.

Future studies with more inclusive study populations are needed, potentially by over sampling of racial/ethnic minorities to further our understanding of cancer outcomes among PwH. In this review, we observed that despite the inclusion of other minority population subgroups such as Asian Pacific Islanders and Native American/Alaska Natives, their small sample size in several studies made it difficult to examine disparities relative to larger groups. Understanding specific health needs in racial/ethnic minority groups living with HIV will allow healthcare providers, government, and policy makers to strategize tailored approaches to provide an equitable healthcare across all individuals at risk or living with cancer and HIV in the US.

While our review identifies gaps in the literature and areas for further inquiry, it is not without limitation. We focused on racial/ethnic disparities in this report even though there are other forms of health disparities such as geographic and socioeconomic disparities. Given the relatively low number of studies on racial/ethnic disparities in the published literature and the role that racial/ethnic disparity plays as a proxy for other issues in the healthcare system, we believe that our conclusion of the need for more studies on cancer health disparities among PwH is robust. Also, we did not limit our inquiry to a specific time-period within the 40-year window of HIV's history. Health disparities are not static and can be influenced by changing policies, programs, practices, and perceptions. Given the sparsity of studies on racial/ethnic disparities among PwH by cancer type and outcome across the entire period, it would not have been feasible to limit our review to a shorter time frame. Finally, we could not perform a meta-analysis and provide overall summary statistics due to heterogeneity of study design and overall poor quality of identified studies. We, however, provided a qualitative summary of our findings and discussed implications. Despite these

limitations, our systematic review provides the groundwork for future research by highlighting gaps in the literature that need to be filled.

Conclusions

Overall, our findings suggest that there are racial/ethnic disparities of cancer risk, treatment, and mortality/survival outcomes but no observable disparities related to cancer screening among PwH. There is still more to learn about racial/ethnic disparities within the cancer care continuum and among PwH, given the limited number of studies investigating specific cancer types and outcomes, heterogeneous studies in term of design, statistical estimates, and study populations which made pooling of results difficult, and with an overall poor quality. Additional research on distinct cancer types to expand the breadth of evidence will address existing gaps in knowledge on racial/ethnic disparities among individuals with PwH at risk or living with cancer.

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