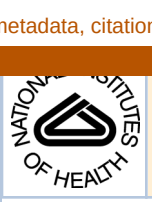

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The State of Disparities in Opportunistic Infection Prophylaxis for Blacks with HIV/AIDS

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Abstract

Objectives—The purpose of this review is to identify and analyze published studies that have evaluated disparities for opportunistic infection (OI) prophylaxis between Blacks and Whites with HIV/AIDS in the United States.

Methods—The authors conducted a web-based search of MEDLINE (1950 to 2009) to identify original research articles evaluating the use of OI prophylaxis between Blacks and Whites with HIV/AIDS. The search was conducted utilizing the following MeSH headings and search terms alone and in combination: HIV, AIDS, Black, race, ethnicity, disparities, differences, access, opportunistic infection, and prophylaxis. The search was then expanded to include any relevant articles from the referenced citations of the articles that were retrieved from the initial search strategy. Of the 29 articles retrieved from the literature search, 19 articles were excluded.

Results—Ten publications met inclusion criteria, collectively published between 1991 and 2005. The collective time periods of these studies spanned from 1987 to 2001. Four studies identified a race-based disparity in that Blacks were less likely than Whites to use OI prophylaxis, whereas five studies failed to identify such a relationship between race and OI prophylaxis. One study

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identified disparities for *Mycobacterium avium* complex (MAC) prophylaxis, but not for *Pneumocystis jiroveci* pneumonia (PCP) prophylaxis.

Conclusions—The evidence regarding race-based disparities in opportunistic infection prophylaxis is inconclusive. Additional research is warranted to explore potential race-based disparities in OI prophylaxis.

Keywords

Race; disparities; HIV/AIDS; opportunistic infection; prophylaxis

Introduction

Opportunistic infections (OIs) are a major source of morbidity and mortality among patients with Human Immunodeficiency Virus (HIV)/Acquired Immunodeficiency Syndrome (AIDS); thus, appropriate antimicrobial prophylaxis against these infections is critical for survival.[1,2] Guidelines for the prevention of *Pneumocystis carinii* pneumonia (also referred to as *P. jiroveci*, or PCP) have been in place since 1989.[3] Since then, the Centers for Disease Control and Prevention (CDC), the National Institutes of Health (NIH), and the HIV Medicine Association of the Infectious Diseases Society of America have all implemented guidelines to effectively prevent and reduce OIs in HIV-infected persons.[4]

With the use of appropriate OI prophylaxis and potent highly active antiretroviral therapy (HAART), there has been a remarkable decline in the incidence of OIs for the HIV/AIDS population overall.[5-7] For instance, the efficacy of trimethoprim-sulfamethoxazole (TMP-SMX) for preventing PCP was first demonstrated in a small, randomized, controlled trial among HIV patients diagnosed with Kaposi sarcoma; no patient using prophylaxis in the study developed PCP infection.[8] Over the years, several other agents have been incorporated as recommended and/or alternative therapies for preventing PCP including pentamidine, dapsone, atovaquone, and pyrimethamine plus leucovorin.[4] PCP primary prophylaxis is indicated among HIV-infected individuals with CD4+ <200, or who have a history of oropharyngeal candidiasis. Primary prophylaxis is also available for *Mycobacterium avium complex* (MAC) and may include azithromycin, clarithromycin, or rifabutin, and is indicated for individuals with a CD4+ <50. Guideline recommendations have also incorporated preventative measures for a number of other OIs and are outlined in Table 1.[4]

While effective prophylaxis has been available for over two decades, it is questionable whether all populations, including the Black U.S. population, use timely prophylaxis for OIs. Blacks represent a small proportion (13%) of the U.S. population, yet they account for 48% of all HIV/AIDS diagnoses and 49% of new AIDS diagnoses.[9,10] Many individuals unaware that they are infected only seek care after they display symptoms of an underlying OI.[11-13]

Blacks are more likely to be “late-presenters” than Whites.[11] These late presenters may not receive the full clinical benefits of therapy as they are at advanced stages of immunosuppression and are risk for suffering poorer outcomes, including higher rates of mortality.[14-16] Furthermore, many prophylactic therapies were evaluated in clinical trials with a limited number of Black patients; therefore, the safety and efficacy of these therapies for the Black HIV/AIDS population is largely unknown.[17,18] The present study sought to: 1) evaluate the available literature pertaining to racial disparities in OI prophylaxis, 2) determine the extent to which preventative measures reach Blacks and Whites with HIV/AIDS, and 3) propose areas for future research for OI prophylaxis disparities.

Methods

A web-based search of MEDLINE (January 1, 1950 to December 31, 2009) was performed to identify articles published in the English language that evaluated the use of OI prophylaxis between Blacks and Whites with HIV/AIDS. For the purposes of this review, OI prophylaxis "use" refers to both prescription of OI prophylaxis and receipt of OI prophylaxis. The search was conducted utilizing the following search terms alone and in combination: "*HIV*," "*AIDS*," "*Black*," "*race*," "*ethnicity*," "*disparities*," "*differences*," "*access*," "*opportunistic infection*," and "*prophylaxis*." The search was then expanded to include any relevant articles from the referenced citations of the articles that were retrieved from the initial search strategy.

Articles were included if they met the following criteria: evaluated OI prophylaxis use, presented original data, included only U.S. study populations, analyzed Black race/ethnicity race-based disparities for OI prophylaxis, studied non-pediatric populations, and involved prophylaxis pertaining to HIV infection. All abstracts were initially screened for the above criteria.

Results

We summarize the findings of the ten publications that met inclusion criteria, collectively published between 1991 and 2005. The study periods spanned from 1987 to 2001. A flowchart of the manuscript selection process is illustrated in Figure 1 and an overview of the individual study results is presented in Table 2. Of the 29 articles retrieved from the literature search, 19 articles were excluded because they failed to meet inclusion criteria outlined in the methods; 12 did not evaluate racial disparities in OI prophylaxis, three did not present original data, two encompassed pediatric populations, one encompassed non-U.S. study populations and the last article did not involve OI prophylaxis pertaining to an HIV population.

Studies that Documented Black-White Disparities for OI Prophylaxis

The following studies detected a race-based disparity, in that Blacks were less likely to use OI prophylaxis as compared to Whites. From 1993 to 1995, Solomon *et al.* recruited women with HIV or at risk for HIV infection from clinical care centers of a prospective cohort, the HIV Epidemiology Research Study (HERS).[19] Women completed interview-administered questionnaires and were instructed to describe their utilization of HIV health services, including use of HIV-related medications. Black women were less likely to report current PCP prophylaxis use compared to White women, (adjusted odds ratio, 0.34; 95% CI, 0.13-0.85). Black women were also less likely to report current prophylaxis for other OIs compared to White women, (adjusted odds ratio, 0.50; 95% CI, 0.30-0.83). Siegel *et al.* sought to evaluate disparities in HIV care by interviewing HIV-positive women in New York City between 1994 and 1995.[20] Blacks reported lower use of aerosolized pentamidine than Whites (0% vs. 13%; $p<0.05$) but no differences were noted for TMP-SMX or dapsone. Regression analyses were not conducted in this study so the authors were unable to control for other variables that could have influenced their study results. Sackoff *et al.* retrospectively assessed trends in HIV-related medications for patients seen in New York City clinics from 1995 to 1997.[21] Race was not associated with PCP prophylaxis; however, Blacks were less likely to use MAC prophylaxis compared to Whites, (adjusted odds ratio 0.08; 95% CI, 0.01-0.52). Shapiro *et al.* prospectively evaluated variations in medication utilization within the HIV Cost and Services Utilization Study (HCSUS) from 1996-1998.[22] Per multivariable analysis, Blacks had a higher likelihood for *not* using PCP prophylaxis within the six months prior to the initial interview compared to Whites, (adjusted odds ratio, 1.54; 95% CI, 1.03-2.29). Lastly, in 1996, Jeffe *et al.* interviewed HIV-positive patients

regarding their current use of HIV medications.[23] Of all participants, fewer Blacks recognized any of the PCP prophylactic medications compared to Whites (65% vs. 88%; $p<0.001$).

Studies that Did Not Document Black-White Disparities for OI Prophylaxis

The following studies did not detect an association between race and OI prophylaxis. Easterbrook *et al.* prospectively evaluated racial differences in PCP prophylaxis among HIV/AIDS individuals in metropolitan centers across the United States from 1987 to 1988.[24] While Blacks were less likely to use PCP prophylaxis at time of study enrollment and at follow-up, the authors concluded that race did not have a significant effect on OI prophylaxis use at follow-up after adjusting for differences in prophylaxis use across the different study sites. Moore *et al.* prospectively collected data from medical records and patient interviews for HIV/AIDS patients seeking care at the Johns Hopkins Hospital AIDS Service HIV clinic between 1990 and 1992.[25] No racial differences were noted for PCP prophylaxis use as patients continued in care (regression analyses were not presented in the study results). Similar to that of the Moore *et al.* study, Smith *et al.* collected data via a series of patient interviews and medical chart abstractions within the AIDS Costs and Services Utilization Survey (ACSUS) from 1991 and 1992.[26] The adjusted odds ratio for Blacks (vs. Whites) for the likelihood of PCP prophylaxis use among all participants was 0.87 (95% CI, 0.70-1.07). For those with a CD4+ <200 or with a history PCP, the adjusted odds ratio was 0.83 (95% CI, 0.65-1.06). From 1996 to 1997, Asch *et al.* sought to characterize the influence of demographic factors on rates of primary prophylaxis for both PCP and MAC in the nationally representative HCSUS.[27] The investigators concluded that Blacks, compared to Whites, were not disadvantaged regarding PCP prophylaxis at baseline (adjusted odds ratio, 0.93, 95% CI 0.47-1.9). The adjusted odds ratio for PCP prophylaxis at follow-up was mistakenly not reported; nevertheless, the 95% CI was 0.54-2.4, implying a lack of statistical significance. Blacks were less likely than Whites to use MAC prophylaxis at baseline, (adjusted odds ratio, 0.35; 95% CI, 0.20-0.59). This race-based disparity no longer existed for Blacks at study follow-up, (adjusted odds ratio, 0.86; 95% CI, 0.37-2.0). The most recent findings are from a cross-sectional, observational study by Gebo *et al.* in 2001, which sought to identify demographic factors that were associated with lack of OI prophylaxis within the HIV Research Network (HIVRN).[28] Blacks were equally as likely as Whites to use PCP prophylaxis, (adjusted odds ratio without outpatient utilization, 0.95; 95% CI, 0.68-1.32; adjusted odds ratio with outpatient utilization, 0.99; 95% CI, 0.71-1.39). No disparities were noted for Blacks using MAC prophylaxis compared to Whites (adjusted odds ratio without outpatient utilization, 0.87; 95% CI, 0.48-1.57; adjusted odds ratio with outpatient utilization, 0.90; 95% CI, 0.49-3.03).

Discussion

Based on the studies identified in this literature review, the evidence regarding racial disparities for the use of OI prophylactic regimens remains inconclusive. The studies vary in the sources of data used, definitions of a prophylactic regimen, variables included in regression analyses (if performed at all), and in terms of study duration. However, all of the studies did evaluate PCP prophylaxis. Other studies have tested the hypothesis that Blacks with HIV/AIDS use sub-optimal antiretroviral therapy and experience poorer health outcomes compared to Whites with HIV/AIDS.[29-34] However, the evidence to support this hypothesis remains inconclusive.

One consistent element throughout the majority of studies that documented race-based disparities was their source of data collection.[19,20,22,23] These studies relied only on data collected from one-on-one interviews and patient questionnaires. It is possible that these studies introduced recall bias into their results, a bias that has previously noted in HIV

patients in assessing medication use.[35,36] Patients may not have recalled specific clinical details about medications used whereas medical records and patient charts are typically completed by trained medical professionals and provide much more detailed information. For instance, Shapiro *et al.* instructed patients to provide a range of CD4+ counts if they could not recall the exact value.[22] Monitoring CD4+ count is imperative to assessing when a patient should be placed on OI prophylaxis.[4] A patient-reported range or estimate may skew the proportion of patients that truly require prophylaxis, which may have influenced some of their study outcomes.

Another bias with patient interviews is the attitude of distrust held by some Black study subjects, which may have precluded them from fully engaging in research activities. Black study participants have been shown to be less trusting of research investigators than White study participants.[37] After surveying Black and White individuals across the United States regarding their attitudes and reservations for engaging in research activities, Blacks were more likely to cite reasons for not participating compared to Whites. One reason included distrust that their physicians would not fully explain the risks associated with participation in such research. They also did not believe they could freely ask their physician questions.[37]

Yet another issue involved cultural competency. Cultural competency refers to how one can effectively interact with individuals of other cultural backgrounds. A survey in Baltimore, MD was conducted to observe how minority patients rated their physicians' level of cultural competency.[38] Patients of physicians with greater cultural competency were more likely to share information with their physicians. Black participants completing interviews may be negatively influenced if the interviewees or medical professionals are of a non-Black race. On the contrary, there are data to suggest that patient-provider race concordance has a negligible impact on minority health. A systematic review of the literature concluded that the evidence supporting an association between concordant race and health outcomes is in fact inconclusive.[39] Future investigations should strive to identify factors that may influence the interaction between Black and other minority patients and their healthcare providers.

Of the six studies that did not document racial disparities for PCP prophylaxis, the studies by Moore *et al.* and Asch *et al.* were the only two to evaluate disparities longitudinally by assessing prophylaxis usage at study entry and at follow-up.[25,27] Their findings suggest that Blacks may be less likely to use prophylaxis when they first enter care, but any perceived differences may dissipate as they continue to use proper follow-up. Additionally, five of the six studies incorporated some form of medical record/patient chart abstraction as a method for data collection.[21,24-26,28] This implies that collecting objective, clinical data from medical records may be a more reliable source of determining the presence of disparities in prophylaxis rather than gathering subjective data from patient interviews and questionnaires alone.

Interestingly, the findings from the present literature review differ from the findings a previous literature review conducted by Palacio *et al.*[40] Most of the studies from their review did not find ethnic minorities to be disadvantaged in regards to use of OI prophylaxis. Some of these discrepancies may be explained by the differences in the search strategy. For example, Palacio *et al.* did not explicitly include studies that evaluated Black-White disparities; rather, they evaluated White/non-White disparities. This resulted in five articles that were excluded from the present review. They also searched the HealthSTAR database in addition to MEDLINE, whereas the present study only searched the MEDLINE database. Additionally, their literature search was conducted on October 1, 2001, which precluded them from identifying two of the articles included in the present review (published December 2001 and September 2005).[27,28]

Limitations of this Literature Review

Some limitations should be considered when interpreting the findings of this literature review. Despite an attempt to include all relevant studies, some studies may have been omitted due to the inclusion/exclusion criteria. The review relied on full-text studies that were published in peer-reviewed journals that are indexed in MEDLINE. Additionally, this review did not attempt to evaluate the quality of the individual studies. Patient presentation at entry to care was not evaluated, which may influence eligibility for prophylaxis. Finally, publication bias may have influenced some authors' decisions to submit their study results for publication due to a lack of statistically significant study findings.

Recommendations for Future Research

Further research is needed to determine whether any racial disparities currently exist in the use of OI prophylaxis. HAART was first made available in 1996.[41] The studies discussed in this review were conducted between 1987 and 2001. Their findings, although mixed, may not reflect recent changes in HIV/AIDS clinical practice, thereby creating a gap in knowledge for potential disparities in the past decade.

While many of these studies evaluated "prophylaxis use," the studies did not delve deeply into medication-specific information such as patient safety, pharmacokinetics-pharmacodynamics, and drug-drug interactions. It is possible that not all patients are compliant with these recommendations for various reasons and may not receive the full benefits of treatment. Focusing on these issues may provide deeper insight into what has been previously denoted as use of OI prophylaxis in the literature.

Based on this review, one may conclude that Blacks may not be disadvantaged for prophylaxis once they receive care. However, patients can only use prophylaxis once they have sought care, which raises the complex issue of race-based disparities in access to care. Future studies should assess for prophylaxis disparities in settings where Black and White HIV/AIDS patients have equal access to care. Such studies should also evaluate disparities in testing, delays in care, and presentation at entry into care. This would provide further insight into differences in prophylaxis eligibility by accounting for "late-presenters" who may require OI treatment rather than prophylaxis. However, it may become increasingly difficult to study OI-related disparities as HAART continues to reduce the overall incidence of these infections in the U.S. HIV/AIDS population. Perhaps the question of such disparities may extend to other populations, such as those in resource-limited settings, where OIs remain a common occurrence.

Conclusion

The evidence regarding race-based disparities in opportunistic infections is inconclusive. Blacks may not necessarily be disadvantaged in using prophylactic medications; however, certain medication-specific issues regarding prophylaxis have not been fully evaluated. Future research should explore potential disparities in dose, patient safety, pharmacokinetics-pharmacodynamics, and drug interactions. Such work has the potential to identify OI prophylactic therapies with the best safety and efficacy profiles for Blacks with HIV/AIDS, reduce the occurrence of preventable OIs, and improve health outcomes for this high-risk population.

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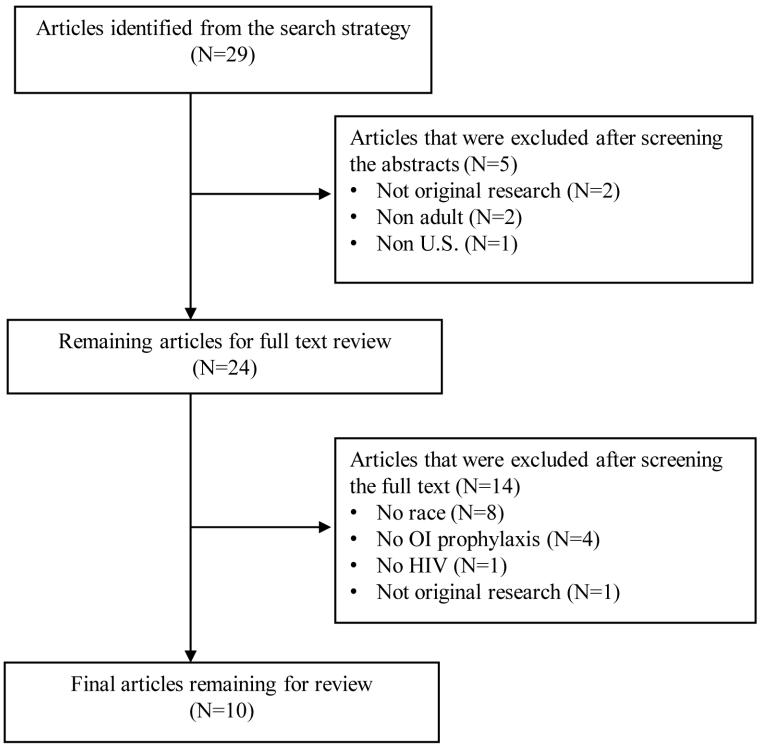

Figure 1.
Process of article selection for the literature review

Table 1

Prophylaxis to prevent first episode of opportunistic disease in adults and adolescents with HIV

Pathogen	Indication	Criteria for Discontinuing Prophylaxis	First Choice	Alternatives
Pneumocystis pneumonia (PCP)	CD4+ < 200 or oropharyngeal candidiasis	CD4+ >200 for 3 months in response to antiretroviral therapy	TMP-SMX 1 DS PO QD -or- TMP-SMX 1 SS PO QD	TMP-SMX 1 DS PO TIW -or- dapsone 50mg PO BID or 100mg PO QD -or- dapsone 50mg PO QD + pyrimethamine 50mg PO QW + leucovorin 25mg PO QW -or- aerosolized pentamidine 300mg QM -or- atovaquone 1,500mg PO QD -or- atovaquone 1,500mg + pyrimethamine 25mg + leucovorin 10mg PO QD
Mycobacterium tuberculosis				
Isoniazid-sensitive	TST reaction ≥ 5 mm or prior positive TST without treatment or contact with case of active tuberculosis regardless of TST result		Isoniazid 300mg PO + pyridoxine 50mg PO QD for 9 months -or- isoniazid 900mg PO + pyridoxine 100mg PO BIW for 9 months	Rifampin 600mg PO QD for 4 months -or- rifabutin 300mg PO QD for 4 months -or- pyranzinamide 15-20mg/kg PO QD for 2 months + either rifampin 600mg PO QD for 2 months or rifabutin 300mg PO QD for 2 months
Isoniazid-resistant	Same as above; high probability of exposure to isonazid-resistant tuberculosis		Rifampin 600mg PO -or- rifabutin 300mg PO QD for 4 months	Pyranzinamide 15-20mg/kg PO QD + either rifampin 600mg PO -or- rifabutin 300mg PO QD for 2 months
Multi-drug (isoniazid and rifampin) resistant	Same as above; high probability of exposure to multi-drug resistant tuberculosis		Dependent on susceptibility isolate from individual source patient	N/A
Toxoplasmosis gondii	IgG antibody to *Toxoplasma* and CD4+ < 100	CD4+ > 200 for 3 months in response to antiretroviral therapy	TMP-SMX 1 DS PO QD	TMP-SMX 1 SS PO QD -or- dapsone 50mg PO QD + pyrimethamine 50mg PO QW + leucovorin 25mg PO QW -or- dapsone 200mg + pyrimethamine 75mg + leucovorin 25mg PO QW -or- atovaquone 1500mg PO QD +/− 25mg PO QD + leucovorin 10mg PO QD

Pathogen	Indication	Criteria for Discontinuing Prophylaxis	First Choice	Alternatives
Mycobacterium avium complex (MAC)	CD4+ < 50	CD4+ >100 for 3 months in response to antiretroviral therapy	Azithromycin, 1200mg PO QW -or- clarithromycin 500mg PO BID	Rifabutin 300mg PO QD -or- azithromycin 1200mg PO QW + rifabutin 300mg PO QD
Varicella zoster virus (VZV)	Significant exposure to chickenpox or shingles for patients who lack a history or either -or- if patient negative antibody to VZV	N/A	Varicella immune globulin (VZIG), 5 vials (1.25mL each) IM	N/A
Streptococcus pneumoniae	All patients	N/A	Pneumococcal vaccine 0.5mL IM x 1	N/A
Hepatitis B virus	All susceptible (anti-HBc-negative) patients	N/A	Hepatitis B vaccine: 3 doses	N/A
Influenza virus	All patients (annually, before influenza season)	N/A	Inactivated trivalent influenza virus vaccine: one annual dose of 0.5mL IM	Oseltamavir 75mg PO QD (influenza A or B) -or- rimantadine 100mg PO BID -or- amantadine 100mg PO BID (influenza A only)
Hepatitis A virus (HAV)	All susceptible (anti-HAV-negative) patients at increased risk for HAV infection or with chronic liver disease, including hepatitis B or C	N/A	Hepatitis A vaccine: two doses	N/A

TMP-SMX = trimethoprim-sulfamethoxazole; DS = double strength; SS = single strength; PO = by mouth; BID = twice daily; QD = once daily; TST = tuberculin skin test; BIW = twice weekly; QW = once weekly; TIW = three times weekly; QM = once monthly; IM = intramuscularly

Table 2

Summary of the 10 studies that evaluated racial disparities in opportunistic infection prophylaxis

Study	Study Year	Study Design	Study Setting	N = Study Population, Race (%)	Gender (%)	Target Population	OIs Evaluated (CD4+ criteria)	Likelihood of Using OI Prophylaxis
Studies that detected Black-White disparities for OI prophylaxis								
Solomon L *et al.*[19]	1993-1995	Prospective, observational	4 urban hospitals of HERS (Baltimore MD, The Bronx NY, Detroit MI, Providence RI)	N, HIV-infected = 863 B (58%) W (20%) H (17%) O (5%)	M (0%) F (100%)	Women aged 16 to 55 years HIV+ or at risk for HIV	PCP (CD4+ <200) Other OIs (not specified)	PCP B < W Other OIs B < W
Siegel K *et al.*[20]	1994-1995	Prospective, observational	Patients in NYC	N, Total = 84 B (37%) W (27%) H (36%)	M (0%) F (100%)	Representative sample of HIV+ (non-AIDS) females aged 20-45 years	PCP (not specified)	PCP B < W
Sackoff J *et al.*[21]	1995-1997	Retrospective, observational	4 NYC clinics within the ASD	N, PCP Eligible = 149 B (48%) W (9%) H (43%) N, MAC Eligible = 130 B (55%) W (9%) H (36%) N, *T. gondii* Eligible = 138 B (56%) W (9%) H (35%)	Of PCP-Eligible, M (75%) F (25%) Of MAC-Eligible, M (81%) F (19%) Of T gondii-Eligible, M (81%) F (19%)	Adolescent and adult HIV+ patients receiving medical care	PCP (CD4+ <200) MAC (CD4+ <75) *T. gondii* (CD4+ <145)	PCP B = W MAC B < W *T. gondii* Not applicable
Shapiro MF *et al.*[22]	1996-1998	Prospective, observational	Nationally representative ambulatory care data from the HCSUS	N, at Baseline = 2,864 B (33%) W (49%) H (15%) O (3%)	M (77%) F (23%)	Adult (≥18 years) HIV+ patients across the US	PCP (CD4+ <200)	PCP B < W
Jeffe DB *et al.*[23]	1996	Prospective, observational	Clinics and hospitals in St. Louis	N = 224 B (63%) W (37%)	M (54%) F (46%)	HIV+ patients receiving HIV medical care	PCP (CD4+ <200)	PCP B < W
Studies that did not detect Black-White disparities for OI prophylaxis								

Study	Study Year	Study Design	Study Setting	N = Study Population, Race (%)	Gender (%)	Target Population	OIs Evaluated (CD4+ criteria)	Likelihood of Using OI Prophylaxis
Easterbrook PJ *et al.*[24]	1987-1988	Prospective, observational	Hospitals and private clinics in 12 metropolitan centers	N = 1,025 B (16%) W (74%) H (10%)	M (96%) F (4%)	HIV+ patients with AIDS or ARC with up to 2 years AZT	PCP (CD4+ <200)	PCP B = W
Moore, RD *et al.*[25]	1990-1992	Prospective, observational	Johns Hopkins Hospital AIDS Service in Maryland	N = 838 B (78%) W (20%) O (2%) N, PCP-Eligible = 283 B (75%) W (23%) O (2%)	Of PCP-Eligible, M (79%) F (21%)	Urban HIV+ patients	PCP (CD4+<200)	PCP B < W (baseline) B = W (follow-up)
Smith SR *et al.*[26]	1991-1992	Prospective, observational	Interviews from participants of the ACSUS	N = 1,586 B (29%) W (42%) H (27%) O (2%)	M (82%) F (18%)	Adult (≥25 years) HIV+ individuals	PCP (CD4+ <200)	PCP B = W
Asch SM *et al.*[27]	1996-1997	Prospective, observational	Nationally representative data from the HCSUS	N, = 2,864 (231,000 when weighted) Racial distribution not provided	Gender distribution not provided	Adult (≥18 years) HIV+ patients across the US	PCP (CD4+ <200) MAC (CD4+ <50)	PCP B < W (baseline) B = W (follow-up) MAC B < W (baseline) B = W (follow-up)
Gebo KA *et al.*[28]	2001	Retrospective, observational	Data from 10 of 17 sites in the HIVRN; US sites = East (4), Midwest, (2) South (2), and West (2)	N, PCP-Eligible = 2,533 B (47%) W (28%) H (23%) O (2%) N, MAC-Eligible = 754 B (54%) W (25%) H (20%) O (2%)	Of PCP-Eligible, M (76%) F (24%) Of MAC-Eligible, M (75%) F (25%)	Adult (≥18 years) HIV+ patients across the US	PCP (CD4+ <200) MAC (CD4+ <50)	PCP B = W MAC B = W

Acronyms ACSUS = AIDS Cost and Services Utilization Survey; AIDS = Acquired Immunodeficiency Syndrome; ARC = AIDS-related complex; ASD = Adult/Adolescent Spectrum of Disease; HERS = HIV Epidemiology Research Study; HCSUS = HIV Cost and Services Utilization Study; HIV = Human Immunodeficiency Virus; HIVRN = HIV Network Research Network; MACS = Multicenter AIDS Cohort Study; NYC = New York City; MAC = Mycobacterium avium complex; OI = Opportunistic infection; PCP = Pneumocystis jiroveci pneumonia; TMP-SMX = trimethoprim-sulfamethoxazole

Abbreviations Race: B = Blacks; W = Whites; H = Hispanics; O = Others Gender: M = Male; F = Female