

High Rates of Primary *Mycobacterium avium* Complex and *Pneumocystis jiroveci* Prophylaxis in the United States

Kelly A. Gebo, MD, MPH,* John A. Fleishman, PhD,† Erin D. Reilly, MPH,*
and Richard D. Moore, MD, MHS,* for the HIV Research Network

Background: National data from the mid-1990s demonstrated that many eligible patients with HIV infection do not receive prophylaxis for opportunistic infections (OIs) and that racial and gender disparities existed in OI prophylaxis receipt.

Objective: We examined whether demographic disparities in use of OI prophylaxis persist in 2001 and if outpatient care is associated with OI prophylaxis utilization.

Research Design: Demographic, clinical, and pharmacy utilization data were collected from 10 U.S. HIV primary care sites in the HIV Research Network.

Subjects: This study consisted of adult patients (≥ 18 years old) in longitudinal HIV primary care.

Measures: Indications for *Pneumocystis jiroveci* pneumonia (PCP) or *Mycobacterium avium* complex (MAC) prophylaxis were 2 or more CD4 counts less than 200 or 50 cells/mm³ during calendar year (CY) 2001, respectively. Using multivariate logistic regression, we examined demographic and clinical characteristics associated with receipt of PCP or MAC prophylaxis and the association of outpatient utilization with appropriate OI prophylaxis.

Results: Among eligible patients, 88.1% received PCP prophylaxis and 87.6% received MAC prophylaxis. Approximately 80% had 4 or more outpatient visits during CY 2001. Adjusting for care site, male gender (odds ratio [OR], 1.47), Medicare coverage (OR, 1.60), and having 4 or more outpatient visits in a year (OR, 2.34) were significantly associated with increased likelihood of PCP prophylaxis. Adjusting for care site, having 4 or more outpatient visits in a year (OR, 1.85) was associated with increased likelihood of receipt

of MAC prophylaxis. There were no demographic or insurance characteristics associated with receipt of MAC prophylaxis.

Conclusions: The overall prevalence of OI prophylaxis has increased since the mid-1990s, and previous racial and HIV risk factor disparities in receipt of OI prophylaxis have waned. Integration into the healthcare system is an important correlate of receiving OI prophylaxis.

Key Words: HIV, opportunistic illness prophylaxis, *Pneumocystis jiroveci*, *Mycobacterium avium* complex, gender, disparities

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Opportunistic illnesses (OIs) produce significant morbidity and mortality in patients with HIV. Prophylaxis for *Pneumocystis jiroveci* (formerly *carinii*) pneumonia (PCP) and *Mycobacterium avium* complex (MAC) is recommended by the U.S. Public Health Science and the Infectious Diseases Society of America for HIV-infected patients with CD4 counts below 200 cells/mm³ or 50 cells/mm³, respectively.¹

The epidemiology of HIV infection in the United States is changing. Blacks and Latinos are now disproportionately affected by the epidemic.² In addition, HIV is also affecting greater numbers of women and those with a history of substance abuse than in previous years.² Many studies of patients without HIV infection have demonstrated disparities in healthcare utilization, healthcare access, and health status by gender and race/ethnicity.³⁻⁶ In view of the changing epidemiologic profile of persons with HIV infection, such disparities assume greater importance for HIV care.

The evidence for racial and ethnic disparities in the receipt of OI prophylaxis is mixed. Some studies have demonstrated a negative association between nonwhite race and PCP prophylaxis,⁷⁻¹³ but others have found no association.¹⁴⁻¹⁷ Two other studies have demonstrated less receipt of MAC prophylaxis in racial minorities.^{7,18} A review of the literature concluded that the preponderance of evidence across time shows that HIV-infected minorities have had lower rates of antiretroviral therapy and PCP prophylaxis than HIV-infected whites.¹⁹ Other work has demonstrated

From the *Department of Medicine, Johns Hopkins University School of Medicine, Baltimore, Maryland; and the †Center for Financing, Access, and Cost Trends, Agency for Healthcare Research and Quality, Rockville, Maryland.

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Reprints: Kelly Gebo, MD, MPH, Johns Hopkins University School of Medicine, 1830 E. Monument St., Room 442, Baltimore, MD 21287. E-mail: kgebo@jhmi.edu.

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that disparities exist in access to PCP prophylaxis by HIV risk factor, with men who have sex with men (MSM) more likely to receive PCP prophylaxis than injection drug users (IDUs).^{7,12}

One factor that might account for some of the differences in receipt of OI prophylaxis is the extent to which the patient is integrated into the healthcare system. Patients who appear regularly for monitoring may be viewed as better candidates for OI prophylaxis than those who have only intermittent contact with healthcare providers. One indicator of such integration is the number of outpatient visits made by the patient. Frequent outpatient monitoring could be seen as the mechanism through which demographic factors affect the likelihood of receiving prophylaxis for PCP or MAC.

This article reports on the use of PCP and MAC prophylaxis in calendar year 2001 and examines the associations between PCP and MAC prophylaxis use and various demographic and clinical characteristics. We also sought to determine if outpatient utilization mediated the association of gender and race/ethnicity with PCP and MAC prophylaxis utilization.

METHODS

Site Selection

The HIV Research Network (HIVRN) is a consortium of 17 sites that provide primary and subspecialty care to patients with HIV. To be included, a site had to have a minimum dataset available in electronic format or through paper abstraction. The minimum data required were the patients' age, sex, race, HIV transmission risk factor, AIDS-defining illnesses, CD4 level, HIV-1 RNA, and use of anti-retroviral medication. Fifteen sites collect data on adult patients, and 10 of these sites also collect data on OI prophylaxis medications. Data from these 10 sites, located in the eastern (4), midwestern (2), southern (2), and western (2) United States, were included in this analysis. Eight of these sites have academic affiliations; 2 are community-based. This analysis was limited to adult patients (≥ 18 years old) who were in longitudinal HIV primary care at one of these HIVRN sites. Primary care was defined by having at least one visit to the primary care provider and a CD4 count drawn between January 1, 2001, and July 1, 2001.

Data Collection

The data elements described here were abstracted from electronic or paper records at each individual site. Abstracted data were sent in electronic format to a data coordinating center after personal identifying information was removed. A uniform format was used for the analytic database. For this analysis, data collection encompassed the time period of January 1 through December 31, 2001. The date of the outpatient encounter (not the date of billing or payment of

claim) was used. Quality assurance protocols at the data coordinating center included review of all electronic data and assessment to ensure that each data element was correctly formatted and that all elements were captured. Data elements with incorrect formatting with unknown or incomplete information, or other inaccuracies, were reviewed with the site and corrected. In addition, all site-specific data were reviewed and compared with the network as a whole. All outlier data were verified independently with the sites. Finally, patients who had an indication for OI prophylaxis but who were not reported as taking the necessary medication were checked with the site for confirmation. After this verification process, the data were combined across sites to achieve a uniformly constructed multisite database. A variable identifying the site was included in this database.

Definitions of Variables

PCP prophylaxis was defined as receipt of trimethoprim-sulfamethoxazole, dapsone, atovaquone, or aerosolized pentamidine. MAC prophylaxis was defined as receipt of azithromycin, clarithromycin, or rifabutin.

HIV transmission risk factors included IDU, MSM, and heterosexual transmission (HET), which was defined as either heterosexual activity with a partner at high risk for HIV or sex with an HIV-infected individual. Risk factor information was not mutually exclusive, because multiple HIV risk factors were recorded. However, for purposes of analyses, patients were classified as having either an IDU risk factor (alone or in conjunction with another risk factor) or non-IDU. Insurance was categorized into private, Medicaid, Medicare, self-pay/Ryan White, and other. Patients with dual Medicare/Medicaid insurance ($n = 36$) were classified as Medicare, because Medicare is the primary payer for these patients. Patients classified as self-pay/Ryan White were considered to be uninsured. Adequate outpatient utilization was defined as 4 or more visits in a calendar year, consistent with the IAS-USA guidelines, which recommend at least quarterly visits for HIV-infected patients.^{20,21} For this analysis, outpatient visits were limited to nonemergency department visits to a primary healthcare provider and did not include administrative visits, laboratory testing, or other encounter visits in which a healthcare provider was not seen.

Data Analysis

In 2001, the U.S. Public Health Services and the Infectious Diseases Society of America (USPHS/IDSA) recommended PCP prophylaxis for all patients with CD4 counts less than 200 cells/mm³ and MAC prophylaxis for those with CD4 counts less than 50 cells/mm³.¹ Some clinicians might believe that a single CD4 count less than the recommended threshold is not sufficient evidence to initiate OI prophylaxis. Therefore, for the PCP analysis, we included only patients with 2 or more CD4 counts less than 200 cells/mm³, and for

the MAC analysis, we included only patients with 2 or more CD4 counts less than 50 cells/mm³ during calendar year 2001. Sensitivity analyses were performed by including patients with one or more CD4 counts less than 200 cells/mm³ or less than 50 cells/mm³ for MAC in reanalyses.

We examined bivariate associations between individual demographic and clinical variables and receipt of prophylaxis using logistic regression analyses. We next examined the association of demographic and clinical factors with receipt of OI prophylaxis in multivariate logistic regressions. Finally, we determined if controlling for outpatient utilization altered the associations of demographic and clinical factors with OI prophylaxis.

Analyses were conducted using STATA 8.0 (College Station, TX). To account for variations in practice patterns and demographic differences across sites, all regressions included a set of dummy variables representing each site of care (except for one reference site).

RESULTS

Of 11,732 persons receiving primary care at one of the 10 sites during 2001, 2533 had at least 2 CD4 counts less than 200 cells/mm³ and comprised the analytic sample for PCP prophylaxis; 754 had at least 2 CD4 counts less than 50 cells/mm³ and comprised the analytic sample for MAC prophylaxis.

Table 1 describes demographic, clinical, and insurance characteristics of the analytic samples. (Table 1 shows 9.8% of those eligible for PCP prophylaxis as having CD4 cell counts above 200; these were patients whose initial CD4 results were above 200 but who subsequently had at least 2 CD4 readings below 200.) Of those who qualified for PCP prophylaxis, the sample was predominantly male (76%) and of minority race/ethnicity. The modes of HIV transmission were predominantly MSM (42%), heterosexual (35%), and IDU (23%). The median age was 41 years (range, 18–89 years). Forty-two percent of the sample had Medicaid, 25% had Medicare, 24% were uninsured or enrolled in Ryan White, and 10% had private/commercial insurance. The population eligible for MAC prophylaxis had a similar distribution. The median CD4 level in those who qualified for PCP prophylaxis was 97 cells/mm³ and was 19 cells/mm³ in those who qualified for MAC prophylaxis. The median HIV-1 RNA was 4.52 (log₁₀) copies/mL for the PCP-eligible group and 4.94 (log₁₀) copies/mL in the MAC-eligible group.

***Pneumocystis jiroveci* Pneumonia Prophylaxis**

Overall, 88.1% of patients with 2 or more CD4 counts less than 200 cells/mm³ were receiving PCP prophylaxis in 2001. In bivariate analyses, factors associated with PCP prophylaxis use included male gender (odds ratio [OR], 1.47), Medicare coverage (OR, 1.60) and first CD4 count in 2001 less than 50 cells/mm³ (OR, 1.61), and between 50 and

TABLE 1. Clinical and Demographic Factors of the Study Sample

| Characteristic | PCP-Eligible (n = 2533; %) | MAC-Eligible (n = 754; %) |
|--------------------------------------|-------------------------------|------------------------------|
| Age (years) | | |
| Median | 41 | 39 |
| Range | (19–89) | (19–89) |
| Sex | | |
| Male | 1920 (75.8) | 566 (75.1) |
| Female | 613 (24.2) | 188 (24.9) |
| Race | | |
| White | 708 (28.0) | 186 (24.7) |
| Black | 1195 (47.2) | 403 (53.5) |
| Hispanic | 583 (23.0) | 152 (20.2) |
| Other/unknown | 47 (1.9) | 13 (1.7) |
| HIV transmission risk factor | | |
| MSM | 1053 (41.6) | 304 (40.3) |
| Heterosexual | 893 (35.3) | 295 (39.1) |
| IDU | 589 (23.3) | 153 (20.3) |
| Other/unknown | 123 (4.9) | 42 (5.6) |
| Initial CD4 (cells/mm ³) | | |
| Median | 97 | 19 |
| <50 | 784 (31.0) | 635 (84.2) |
| 51–200 | 1502 (59.3) | 104 (13.8) |
| 201–350 | 227 (9.0) | 8 (1.1) |
| 350–500 | 20 (0.80) | 7 (0.9) |
| HIV-1 RNA (log ₁₀) | n = 2530 | n = 752 |
| Median | 4.52 | 4.94 |
| ≤4.0 | 992 (39.2) | 167 (22.2) |
| 4.0–5.0 | 768 (30.4) | 224 (29.8) |
| ≥5.0 | 770 (30.4) | 361 (48.0) |
| Insurance | | |
| Uninsured/Ryan White | 596 (23.5) | 156 (20.7) |
| Commercial/private | 243 (9.6) | 68 (9.02) |
| Medicaid | 1052 (41.5) | 330 (43.8) |
| Medicare | 642 (25.4) | 200 (26.5) |
| Outpatient (OP) utilization | | |
| 2 OP visits/yr | 180 (7.1) | 41 (5.4) |
| 3 OP visits/yr | 233 (9.2) | 66 (8.8) |
| ≥4 OP visits/yr | 2022 (79.8) | 618 (82.0) |

*Adjusted for care site.

PCP indicates *Pneumocystis jiroveci* pneumonia; MAC, *Mycobacterium avium* complex; MSM, men who have sex with men; IDU, injection drug user.

200 cells/mm³ (OR, 1.55) (Table 2). Age, race, and HIV risk factor were not associated with receipt of PCP prophylaxis.

In multivariate analysis, excluding outpatient visits from the model, male gender was associated with PCP prophylaxis (adjusted odds ratio [AOR], 1.36). Patients with Medicare were more likely to receive PCP prophylaxis than

TABLE 2. Bivariate and Multivariate Analysis of Factors Associated With Receipt of *Pneumocystis jiroveci* Pneumonia Prophylaxis

| Characteristic | Bivariate* | | Multivariate Without Outpatient Utilization* | | Multivariate With Outpatient Utilization* | |
|-------------------------------------|---------------------|-----------|--|-----------|---|-----------|
| | Odds Ratio (95% CI) | P | Adjusted Odds Ratio (95% CI) | P | Adjusted Odds Ratio (95% CI) | P |
| Age ≥40 yr | 1.16 (0.90–1.49) | 0.245 | 1.13 (0.87–1.46) | 0.349 | 1.11 (0.85–1.43) | 0.450 |
| Male | 1.47 (1.10–1.97) | 0.009 | 1.36 (1.00–1.84) | 0.047 | 1.35 (0.99–1.83) | 0.056 |
| Race/ethnicity | | | | | | |
| White | 1.0 | Reference | 1.0 | Reference | 1.0 | Reference |
| Black | 0.82 (0.59–1.12) | 0.215 | 0.95 (0.68–1.32) | 0.749 | 0.99 (0.71–1.39) | 0.960 |
| Hispanic | 0.93 (0.64–1.35) | 0.707 | 1.04 (0.71–1.53) | 0.836 | 1.03 (0.70–1.52) | 0.880 |
| Other | 0.49 (0.21–1.11) | 0.089 | 0.53 (0.23–1.20) | 0.128 | 0.57 (0.25–1.32) | 0.192 |
| HIV risk factor | | | | | | |
| Non-IDU | 1.0 | Reference | 1.0 | Reference | 1.0 | Reference |
| IDU | 1.20 (0.85–1.71) | 0.305 | 1.25 (0.87–1.81) | 0.234 | 1.28 (0.89–1.85) | 0.183 |
| CD4 count (cells/mm ³) | | | | | | |
| <50 | 1.61 (1.05–2.47) | 0.030 | 1.67 (1.08–2.58) | 0.022 | 1.78 (1.14–2.78) | 0.011 |
| 50–200 | 1.55 (1.04–2.31) | 0.031 | 1.54 (1.03–2.31) | 0.035 | 1.68 (1.11–2.53) | 0.013 |
| >200 | 1.0 | Reference | 1.0 | Reference | 1.0 | Reference |
| Insurance | | | | | | |
| Uninsured | 1.0 | Reference | 1.0 | Reference | 1.0 | Reference |
| Private | 0.82 (0.66–1.28) | 0.483 | 0.79 (0.46–1.35) | 0.387 | 0.77 (0.45–1.34) | 0.362 |
| Medicaid | 0.91 (0.66–1.28) | 0.598 | 0.91 (0.64–1.28) | 0.587 | 0.87 (0.61–1.23) | 0.421 |
| Medicare | 1.60 (1.10–2.32) | 0.015 | 1.52 (1.04–2.22) | 0.032 | 1.46 (0.99–2.15) | 0.053 |
| Outpatient utilization ≥4 visits/yr | 2.34 (1.73–3.16) | <0.001 | | | 2.39 (1.76–3.24) | <0.001 |

*Adjusted for care site.

CI indicates confidence interval; IDU, injection drug user.

those without insurance (AOR, 1.52); the differences between the uninsured, those with private insurance, and those with Medicaid were not significant. Age, race, and HIV risk factor were not associated with receipt of PCP prophylaxis in this analysis. Odds ratios for demographic and clinical variables did not change appreciably from bivariate to multivariate analyses.

Outpatient utilization, defined as 4 or more visits in a year, was significantly associated with receipt of PCP prophylaxis (OR, 2.34) in bivariate analysis. In multivariate logistic regression analyses, when a dichotomous variable indicating 4 or more (vs. 3 or fewer) outpatient visits was added to the model, male gender (AOR, 1.35; $P = 0.056$) and Medicare coverage (AOR, 1.46; $P = 0.053$) no longer were significant at the 0.05 level. Coefficients for most variables did not change appreciably when outpatient visits was controlled. Having 4 or more outpatient visits (AOR, 2.39) continued to be strongly associated with receipt of PCP prophylaxis.

***Mycobacterium avium* Complex Prophylaxis**

Overall, 87.6% of with 2 or more CD4 counts less than 50 cells/mm³ were receiving MAC prophylaxis in 2001. In bivariate analyses, there were no demographic or insurance factors associated with MAC prophylaxis use (Table 3). Outpatient utilization, again defined as 4 or more visits in a year, was significantly associated with receipt of MAC prophylaxis (OR, 1.85) in bivariate analysis. In multivariate analysis, however, the association of outpatient utilization and MAC prophylaxis was no longer statistically significant (AOR, 1.69; $P = 0.09$). Coefficients for other variables showed little change when outpatient utilization was controlled.

Sensitivity Analyses

Sensitivity analysis was performed by relaxing the criterion from 2 or more CD4 counts to one or more CD4 counts less than 200 cells/mm³ for PCP or less than 50 cells/mm³ for MAC prophylaxis. With these more lenient

TABLE 3. Bivariate and Multivariate Analysis of Factors Associated With Receipt of MAC Prophylaxis

| Characteristic | Bivariate* | | Multivariate Without Outpatient Utilization* | | Multivariate With Outpatient Utilization* | |
|-------------------------------------|---------------------|-----------|--|-----------|---|-----------|
| | Odds Ratio (95% CI) | P | Adjusted Odds Ratio (95% CI) | P | Adjusted Odds Ratio (95% CI) | P |
| Age ≥40 yr | 0.84 (0.53–1.31) | 0.434 | 0.85 (0.53–1.35) | 0.484 | 0.85 (0.54–1.36) | 0.509 |
| Male | 1.13 (0.66–1.96) | 0.654 | 1.08 (0.62–1.88) | 0.783 | 1.10 (0.63–1.92) | 0.737 |
| Race/ethnicity | | | | | | |
| White | 1.0 | Reference | 1.0 | Reference | 1.0 | Reference |
| Black | 0.86 (0.48–1.54) | 0.623 | 0.87 (0.48–1.57) | 0.639 | 0.90 (0.49–1.63) | 0.722 |
| Hispanic | 1.45 (0.70–3.00) | 0.319 | 1.44 (0.69–3.02) | 0.336 | 1.44 (0.69–3.03) | 0.335 |
| Other | 0.57 (0.11–2.89) | 0.493 | 0.57 (0.11–3.02) | 0.512 | 0.58 (0.11–3.07) | 0.525 |
| HIV risk factor | | | | | | |
| Non-IDU | 1.0 | Reference | 1.0 | Reference | 1.0 | Reference |
| IDU | 0.65 (0.36–1.15) | 0.140 | 0.66 (0.36–1.20) | 0.176 | 0.68 (0.37–1.23) | 0.201 |
| Insurance | | | | | | |
| Uninsured | 1.0 | Reference | 1.0 | Reference | 1.0 | Reference |
| Private | 0.56 (0.21–1.55) | 0.266 | 0.59 (0.21–1.65) | 0.318 | 0.59 (0.21–1.65) | 0.314 |
| Medicaid | 0.72 (0.37–1.38) | 0.319 | 0.79 (0.41–1.55) | 0.499 | 0.82 (0.42–1.59) | 0.556 |
| Medicare | 1.19 (0.58–2.45) | 0.626 | 1.28 (0.62–2.65) | 0.504 | 1.23 (0.60–2.57) | 0.566 |
| Outpatient utilization ≥4 visits/yr | 1.85 (1.02–3.35) | 0.043 | | | 1.69 (0.92–3.09) | 0.09 |

*Adjusted for care site.

MAC indicates *Mycobacterium avium* complex; CI, confidence interval.

inclusion criteria, the sample sizes increased to 3944 for PCP and 1460 for MAC. For these expanded samples, 82% received PCP prophylaxis and 80% received MAC prophylaxis. The overall trends of the analysis did not change, with 3 exceptions: Male gender was significant in the multivariate model for PCP prophylaxis adjusting for outpatient utilization (AOR, 1.25; 95% confidence interval [CI], 1.02–1.53; $P = 0.03$), and the coefficient for Medicare increased in magnitude and was also significant (AOR, 2.78; 95% CI, 1.36–2.34; $P < 0.001$). With the expanded inclusion criteria, IDU was significant in the multivariate model for MAC (AOR, 0.62; 95% CI, 0.43–0.88; $P = 0.007$).

DISCUSSION

This study—from a multistate, multisite patient sample—has several important findings. First, 88.1% of eligible patients received PCP prophylaxis and 87.6% received MAC prophylaxis. This is significantly higher than has been reported in other studies, which have demonstrated rates of approximately 65% to 80% for PCP and 40% for MAC.^{7,12} This may be the result of heightened knowledge on the part of HIV providers or increased access by patients since the earlier studies were conducted. This finding may also reflect

the selection of high-volume HIV specialty providers into the HIVRN.

Second, unlike previously reported disparities that existed with highly active antiretroviral therapy (HAART),^{22–25} few demographic disparities exist in the receipt of OI prophylaxis therapy in our HIV-infected patients. In particular, blacks, IDUs, and those who were uninsured or who had private insurance were as likely to receive clinically indicated OI prophylaxis as whites, Hispanics, those with risk factors other than IDU or those who had Medicaid coverage. This suggests that unlike HAART, providers and patients are more appropriately following recommendations for OI prophylaxis.

Several factors could explain these results. Appropriate OI prophylaxis is one standard of adequate HIV care. Also, the guidelines for OI prophylaxis may be clearer than those for initiation of HAART, with less ambiguity concerning the clinically appropriate time to begin treatment. Providers may be aware of the urgency of medical treatment as the CD4 count falls below 200 cells/mm³ and may not wait for patients' readiness for therapy or abstinence from drugs and alcohol. Prophylaxis drugs are easier to administer with less difficulty in restarting if a patient self-discontinues the med-

ication compared with HAART. Alternatively, patients with relatively advanced HIV disease may feel poorly from their HIV and may be more willing to take prophylaxis to improve their symptoms than antiretroviral treatment. Finally, patients may be more willing to take OI prophylaxis because there are fewer side effects compared with HAART.

We used history of IDU in our analyses. Unfortunately, we were unable to distinguish active users from former drug users. As several previous studies have demonstrated,^{26,27} former drug users often mirror never drug users with respect to adherence, virologic suppression, immunologic rebound, and clinical outcomes. One potential reason for the lack of association of prophylaxis and IDU may be potential misclassification of drug use. Future work will need to evaluate the impact of active illicit drug use compared with former drug use in the receipt of appropriate OI prophylaxis.

Men were more likely than women to receive PCP prophylaxis but not MAC prophylaxis. A recent study also reported similar results.¹² Although female gender may in general be associated with lack of access to medical care, this does not explain the current results because the odds of receiving PCP prophylaxis remained greater for males than for females even after controlling for outpatient utilization. This demonstrates that even women with advanced HIV, as measured by multiple CD4 counts less than 200 cells/mm³, who were engaged in HIV care are less likely to be prescribed appropriate PCP prophylaxis than men. Interestingly, like Asch, we found no difference in MAC prophylaxis by gender.⁷

Patients with Medicare were more likely to receive PCP prophylaxis than those who were uninsured (including those with services funded by Ryan White) or who had private/commercial insurance. Medicare does not typically include pharmacy coverage; thus, the positive association between Medicare and PCP prophylaxis was surprising. Because Medicare eligibility requires a 2-year waiting period for persons under 65 receiving Social Security Disability Insurance (SSDI), patients on Medicare may have more advanced HIV disease than others and may be more likely to be engaged in care, because a physician has to certify that they are disabled. Despite restricting the analyses to patients with CD4 counts below 200 cells/mm³, unmeasured variation in disease severity may partially explain the association between Medicare and PCP prophylaxis.

Other research has found that patients with both Medicaid and Medicare coverage initiated HAART more rapidly and persisted on HAART regimens longer than those with only Medicaid coverage.²⁸ It should also be acknowledged that dual coverage may not be accurately recorded in medical records; only a handful of dual eligibles were identified in the data, and some proportion of those classified as Medicare may also have Medicaid coverage.

On the other hand, the lack of a significant difference in receipt of PCP prophylaxis between the uninsured and those with private insurance is contrary to prior findings.^{13,25} There are several potential reasons for this finding. Some private insurance programs do not have prescription coverage, and patients who have employer-based private insurance often exceed income requirements for public pharmacy assistance programs. In addition, other studies have demonstrated that as copayments increase, patients may be less likely to continue expensive medications.²⁹ Finally, our model included AIDS Drug Assistance Program (ADAP) programs and Ryan White as uninsured. Expansions in ADAP between 1997 and 2001 may have improved access to medications for patients without insurance.

We used 4 visits per year to identify persons with appropriate outpatient utilization, because standards suggest that patients with HIV should be seen and evaluated at least on a quarterly basis.^{20,21} Consistent with another study that found outpatient utilization was associated with OI prophylaxis prescription,¹² we found that the factor most strongly associated with PCP and MAC prophylaxis use was 4 or more outpatient visits per year. Although it is possible that patients who were more symptomatic or in more advanced stages of disease were likely to have more visits, and thus more likely to receive OI prophylaxis, all of the patients in our analyses were immunosuppressed with CD4 counts less than 200 or 50 cells/mm³, respectively. More outpatient utilization could be associated with increased likelihood of OI prophylaxis receipt for several reasons, including greater access to healthcare providers, more regular visits to assess adherence, greater acceptance of therapy by those who attend clinics more frequently, and a better understanding of the patients' social situation and potential barriers to adherence by the provider. It seems unlikely that receipt of OI prophylaxis could lead to greater numbers of outpatient visits for appropriate monitoring; however, the study design does not permit an unambiguous causal inference between outpatient utilization and receipt of appropriate OI prophylaxis.

The results provided little support for the hypothesis that outpatient utilization mediated the influence of sociodemographic characteristics on receipt of OI prophylaxis. Support for this hypothesis required that the magnitudes of regression coefficients diminish when outpatient visits were controlled compared with a model in which there was no adjustment for outpatient utilization. For the most part, controlling for outpatient visits had a minor effect on the size of coefficients for other variables.

This study has several important limitations. First, the sample is not nationally representative and does not generalize to all HIV care sites. The sites in the sample do encompass a broad geographic distribution, and multisite studies afford greater generalizability than single-site studies. Moreover, the sites in the HIVRN were all highly experienced in the

treatment of HIV; results may differ at sites with less provider experience with HIV or a smaller caseload of patients with HIV. In addition, not all of the sites in the HIVRN collect comprehensive OI prophylaxis data or outpatient utilization data; therefore we were only able to analyze data from 10 of the 15 adult sites in the Network. Third, we were unable to assess whether patients who were not receiving OI prophylaxis refused it, or whether other complex medical decision-making by them and their providers resulted in their not being on medication. Fourth, the relatively small number of patients eligible for MAC prophylaxis resulted in reduced statistical power to detect differences. Finally, we were unable to assess whether patients were benefiting from OI prophylaxis by decreases in OI incidence, hospitalization rates, or mortality; future studies will address the long-term benefits of treatment in these patients.

In the HAART era, opportunistic illness prophylaxis remains an important therapy to reduce morbidity in HIV-positive patients. Nearly 90% of eligible persons in our cohort received PCP and MAC prophylaxis, respectively, and there were no disparities in prophylaxis by race, age, or HIV risk factor. The factor most strongly associated with receipt of appropriate OI prophylaxis was adequacy of outpatient visits. Thus, our results are consistent with policies that attempt to increase access to care and integration into the healthcare system. Controlling for outpatient utilization did not explain the decreased use of PCP prophylaxis in women and those with Medicare; therefore, efforts to improve access to adequate PCP prophylaxis in women and those with other types of insurance, or no insurance, are also warranted. Overall, however, our results suggest that OI prophylaxis is a “success story” of the delivery of appropriate medical care.

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APPENDIX

Participating Sites

Montefiore Medical Group, Bronx, New York (Robert Beil, MD)

Alameda County Medical Center, Oakland, California (Kathleen Clanon, MD)

Wayne State University, Detroit, Michigan (Lawrence Crane, MD)

Community Health Network, Rochester, New York (Steven Fine, MD)

St. Jude's Children's Hospital, Memphis, Tennessee (Patricia Flynn, MD)

Johns Hopkins University, Baltimore, Maryland (Kelly Gebo, MD, MPH)

Montefiore Medical Group, Bronx, New York (Marc Gourevitch, MD)

Montefiore Medical Center, Bronx, New York (Lawrence Hanau, MD)

Community Medical Alliance, Boston, Massachusetts (James A. Hellinger, MD)

Henry Ford Hospital, Detroit, Michigan (John Jovanovich, MD)

Parkland Health and Hospital System, Dallas, Texas (Philip Keiser, MD)

Oregon Health and Science University, Portland, Oregon (P. Todd Korhuis, MD, MPH)

University of California, San Diego, California (W. Christopher Mathews, MD, MSPH)

Johns Hopkins University, Baltimore, Maryland (Richard D. Moore, MD, MHS)

Tampa General Health Care, Tampa, Florida (Jeffrey Nadler, MD)

Nemechek Health Renewal, Kansas City, Missouri (Patrick Nemechek, DO)

Children's Hospital of Philadelphia, Philadelphia, Pennsylvania (Richard Rutstein, MD)

St. Luke's Roosevelt Hospital Center, New York, New York (Victoria Sharp, MD)

Alameda County Medical Center, Oakland, California (Silver Sisneros, MD)

Drexel University, Philadelphia, Pennsylvania (Peter Sklar, MD)

University of San Diego, Owen Clinic, San Diego, California (Stephen Spector, MD)

Drexel University, Philadelphia, Pennsylvania (James Witek, MD)

Sponsoring Agencies

Agency for Healthcare Research and Quality, Rockville, Maryland (Fred Hellinger, PhD, John Fleishman, PhD, Irene Fraser, PhD)

Health Resources and Services Administration, Rockville, Maryland (Richard Conviser, PhD)

Substance Abuse and Mental Health Services Administration, Rockville, Maryland (Joan Dilonardo, PhD)

Substance Abuse and Mental Health Services Administration, Rockville, Maryland (Laura House, PhD)

Office of AIDS Research, NIH, Bethesda, Maryland (Paul Gaist, PhD)

Data Coordinating Center

Johns Hopkins University (Richard Moore, MD, Principal Investigator, Jeanne Keruly, CRNP, Kelly Gebo, MD, Erin Reilly, MPH, Liming Zhou)