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HIV prescriptions on the frontlines: Primary care providers' use of antiretrovirals for prevention in the Southeast United States, 2017

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Abstract

HIV disproportionately affects persons in Southeast United States. Primary care providers (PCPs) are vital for HIV prevention. Data are limited about their prescribing of antiretrovirals (ARVs) for prevention, including nonoccupational post-exposure prophylaxis (nPEP), pre-exposure prophylaxis (PrEP), and antiretroviral therapy (ART). We examined these practices to assess gaps. During April–August 2017, we conducted an online survey of PCPs in Atlanta, Baltimore, Baton Rouge, Miami, New Orleans, and Washington, DC to assess HIV-related knowledge, attitudes and practices. Adjusted prevalence ratios (aPR) and 95% confidence intervals (CI) were used to estimate correlates of nPEP, PrEP and ART prescribing practices. Adjusting for MSA and specialty, the weighted sample (n =820, 29.6% adjusted response rate) comprised 60.2% white and 59.4% females. PCPs reported ever prescribing nPEP (31.0%), PrEP (18.1%), and ART (27.2%). Prescribing nPEP was associated with nPEP familiarity (aPR =2.63, 95% CI 1.59, 4.35) and prescribing PrEP (aPR= 3.57, 95% CI 2.78, 4.55). Prescribing PrEP was associated with PrEP familiarity (aPR =4.35, 95% CI 2.63, 7.14), prescribing nPEP (aPR =5.00, 95% CI 2.00, 12.50), and providing care for persons with HIV (aPR=1.56, 95% CI 1.06, 2.27). Prescribing ART was associated with nPEP familiarity (aPR= 1.89, 95% CI 1.27, 2.78) and practicing in outpatient public practice versus hospital-based facilities (aPR= 2.14 95% CI 1.51, 3.04), and inversely associated with collaborations involving specialists (aPR= 0.60, 95% CI 0.42, 0.86). A minority of PCPs surveyed from the Southeast report ever prescribing ARVs for prevention. Future efforts should include enhancing HIV care coordination and developing strategies to increase use of biomedical tools.

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Declaration of competing interest

None.

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Appendix A. Supplementary data

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Keywords

HIV; Prescriptions; Prevention; Primary health care

1. Introduction

HIV surveillance data published by the Centers for Disease Control and Prevention (CDC) indicate a trend of reducing HIV incidence in the United States (U.S.) in recent years (Centers for Disease Control and Prevention, 2018a), but disparities remain across various regions and different racial and ethnic groups. Among persons with HIV (PWH) diagnosed in 2017, 52% of all HIV diagnoses occurred in the Southeast U.S., which comprises only 37% of the U.S. population (Centers for Disease Control and Prevention, 2018a). Fifty-three percent of these new diagnoses were made among African Americans, most of whom (80%) were men who have sex with men (MSM) (Centers for Disease Control and Prevention, 2018a). Lack of access to HIV prevention tools contributes to these disparities (Arnold et al., 2017). To reduce HIV incidence, particularly among disproportionately affected populations in the Southeast, public health officials can identify opportunities to improve access to HIV prevention and care tools (Arnold et al., 2017; Elopre et al., 2017).

Antiretrovirals (ARVs) have emerged as potent tools for HIV prevention. For uninfected persons, they can be used as non-occupational post exposure prophylaxis (nPEP) for sexual or injection exposure to HIV (Centers for Disease Control and Prevention, 2005, 2018b). Since receiving approval from the Food and Drug Administration (FDA) in 2012, ARVs have also been used as pre-exposure prophylaxis (PrEP) (Centers for Disease Control and Prevention, 2014) for persons at increased risk of future exposure to HIV. PrEP is an evidence-based HIV prevention strategy that involves taking daily medication to prevent infection via sexual or injection exposure (United States Preventive Services Task Force, 2019). Persons residing in high HIV prevalence areas (which often have elevated rates of poverty) or those reporting recent STI diagnoses likely meet indications for PrEP use (Smith et al., 2018). For PWH, antiretroviral treatment (ART) has been shown to also effectively prevent sexual transmission of the virus to others, a strategy often referred to as treatment as prevention (TasP) (Cohen et al., 2016; Rodger et al., 2016; Bavinton et al., 2018). Despite their proven effectiveness, the extent to which ARVs are used to prevent HIV, particularly among African Americans in the Southeast, remains largely unexamined.

Primary care providers (PCPs), including physicians, nurse practitioners and physician assistants, serve important public health roles in HIV prevention and care (Korthuis et al., 2011; McNaghten et al., 2013). These frontline providers are uniquely positioned to promote the uptake of HIV biomedical interventions, such as use of ARVs for prevention, among underserved populations, including African Americans living in the Southeast (Dorell et al., 2011). The disproportionately low number of HIV clinicians in the region (Gilman et al., 2016) underscores the urgency for engaging PCPs in the uptake of these biomedical prevention interventions.

To address this gap, we examined the associations between prescription practices and selected characteristics among a representative sample of PCPs practicing in six Southeast

metropolitan statistical areas (MSAs) with high HIV burden based on national HIV surveillance data. Our specific objectives included (1) assessing the occurrence of nPEP, PrEP and ART prescribing; and (2) identifying sociodemographic, training, practice-level characteristics and other correlates of prescribing these ARVs for prevention.

2. Methods

2.1. K-BAP Study

We used a cross sectional study design to examine baseline data from the Knowledge, Behaviors, Attitudes and Practices of HIV-Related Care among Providers in the Southeast (K-BAP) study conducted 2017–2018. This study was reviewed and approved by the Chesapeake Institutional Review Board on June 23, 2016. The United States Government, Office of Management and Budget (OMB # 0920–1160) approved the data collection authorization on February 1, 2017. All procedures for human subjects research were performed in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments.

Briefly, we conducted an online survey of PCPs practicing in six high HIV-burden MSAs in the Southeast. The MSA selection criteria included (1) being located in Southeast U.S., (2) having a large African American population (> 20% of adults aged 18–54 years), (3) and having high HIV burden (HIV incidence > 25 cases per 100,000 persons and prevalence > 300 cases per 100,000 persons) in 2014 according to local or state HIV surveillance data. The six selected MSAs included in the study were Atlanta, GA; Baltimore, MD; Baton Rouge, LA; Miami, FL; New Orleans, LA; and Washington, DC. Eligible PCPs consisted of physicians, nurse practitioners and physician assistants who practiced in specialty areas that involve direct primary care to clients (Appendix 1). We combined data from Baton Rouge and New Orleans as well as Baltimore and Washington, DC for analyses because of their geographical proximity. This yielded four geographic regions for analysis.

2.2. Sampling and study population

The study sample was derived from the IQVIA® provider database, which contained a census of all currently active health care providers in the U.S. (IQVIA, 2018). The database included extensive background information about providers such as age, gender, practice location, and contact information. We acquired a sampling frame consisting of 36,489 providers (within the selected MSAs) in practice during January 2017. From this population we selected a representative sample of 7330 providers for survey fielding. We stratified the survey sample by MSAs (n = 6, as described above) and provider types (n = 3, physician, nurse practitioner, and physician assistant). All provider types across the six jurisdictions of this study were permitted to prescribe medication, including ART. For strata with low cell counts, we oversampled to ensure adequate statistical power.

For the final sample of survey responses, we applied base weights representing provider type and provider population size within each MSA. Final weights were derived by combining the base with the nonresponse and post-stratification weights.

2.3. Participant recruitment

We used a multi-mode invitation system to recruit survey respondents to complete the web survey. Providers received a postal mail notification with a survey web link and unique password, followed by a post card reminder approximately two weeks later. An email invitation was sent to arrive concurrently with the mail invitation, followed by three additional email reminders sent approximately one week apart. Providers who did not respond to the mail or email invitations received up to two reminder phone calls. Respondents who followed the survey link provided informed consent before starting the 56-item baseline survey. The survey covered the following items: (1) reviewing and discussing sexual health and risk reduction, (2) screening for HIV and other sexually transmitted infections (STIs), (3) recognizing HIV and offering antiretroviral treatment; (4) discussing the prevention benefit of treatment, and (5) prescribing nPEP and PrEP. Participants who completed the baseline assessment received $20 cash incentive via postal mail.

2.4. Statistical analyses

We developed multivariate models of ever prescribing nPEP, PrEP and ART (to PWH) and used prevalence ratios (PR) to estimate association with characteristics. First, we dichotomized each of the three outcome measures in a manner appropriate for that prescribing procedure. Ever prescribing nPEP and PrEP were categorized as binary measures (yes/no). For prescribing ART to PWH, we rescored responses from the original measure, “Among patients for whom there are no barriers or contraindications to treatment, when would you first prescribe ART?” to a binary measure. The “N/A, I do not prescribe ART” responses were scored as “No, I do not prescribe ART” and all other responses were scored as “Yes, I prescribe ART.” We elected to rescore the ART measure so that the variable structure aligned with the nPEP and PrEP measures for comparison purposes.

Using Rao-Scott χ^2 tests, we next assessed bivariate associations for each of these primary outcomes with the following: selected provider characteristics (gender, race/ethnicity, provider type, age, years as board-certified provider); HIV-related training (ever completed training from AIDS Training and Education Center or completed continuing education course in HIV/AIDS, STDs, sexual history assessment, drug or alcohol assessment, or cultural competency in past 24 months); HIV knowledge (familiarity with nPEP and PrEP); and other factors (MSA, practice setting > 50% of time, providing primary care for PWH, providing care in collaboration with infectious disease physician). Appendix 2 includes a complete list of survey questions/measures used for the analysis.

We examined factors that were statistically associated ($p \leq 0.05$) with ever prescribing nPEP, PrEP and ART. All estimates incorporated the adjusted survey weights. First, the bivariate PRs with 95% CIs were calculated between each ARV prescribing outcomes and the aforementioned measures. Next, we selected and included the statistically significant factors from the bivariate calculations in the three multivariate models. In the models of ever prescribing ART to PWH, we included only data from those who reported seeing PWH (n = 458), since the corresponding measure was based on a survey question asked in the context of providing care to PWH. We derived the final multivariate models using adjusted prevalence ratios (aPR) with 95% CI. We used SAS (Cary, NC-Version 9.3) and SUDAAN

(Research Triangle Park, NC-Version 11) procedures appropriate for analyzing complex sample survey data.

3. Results

Of the 7330 providers contacted during survey fielding, we received 995 provider responses, of which 820 were from eligible providers and were included in the analysis. We calculated the survey response rates based on the standards published by the American Association for Public Opinion Research (AAPOR) (The American Association for Public Opinion Research, 2016). The sampling process yielded a raw response rate of 14.9% (AAPOR RR2: excludes known ineligible respondents from denominator; reasons for ineligibility include postal non-deliverable to provider address, deceased, retired, does not work at facility, does not see patients, or moved) (The American Association for Public Opinion Research, 2016). We calculated the adjusted response rate at 29.6% (AAPOR RR4: excludes known and estimated ineligible respondents from denominator) (The American Association for Public Opinion Research, 2016). This sample size yielded an overall confidence interval of ± 7.0 points (margin of error = ± 3.5%). Even when accounting for the oversampling of small strata (i.e., physician assistants in Baton Rouge), per AAPOR standards our sampling approach provided a more accurate estimate of the population of providers within the selected MSAs.

Based on weighted frequency distribution, provider characteristics included the following: 49.7% ≥ 50 years of age, 59.4% female, and 60.2% white. In addition, our weighted PCP sample comprised physicians (75.6%), of whom about half (47.6%) practiced in the Washington, DC/Baltimore, MD region; 37.7% worked in an outpatient private practice; 23.9% have been board-certified for over 20 years; and 36.3% reported receiving previous HIV-related training. Also, 43.1% of PCPs self-reported providing primary care for PWH. The self-reported prescription rate of the following ARVs for prevention among PCPs were as follows: nPEP (31.0%), PrEP (18.1%), and ART (among PCPs seeing PWH) 27.2% (Table 1). We also found that 43.4% of PCPs who prescribed nPEP (n = 175) also prescribed PrEP and 66.7% of PCPs who prescribed PrEP (n = 114) also prescribed nPEP. Among PCPs who prescribed ART, 36.8% and 51.2% prescribed nPEP (n = 125) and PrEP (n = 86), respectively. When excluding PCPs who provide care with infectious disease physicians (n = 123), 21.5% of PCPs who see PWH prescribe ART.

3.1. Prescribing nPEP

Our final nPEP multivariate model (Table 2) indicated that PCPs who prescribed nPEP were more likely to have a “self-reported good” understanding of nPEP (aPR = 2.63, 95% CI 1.59, 4.35) and more likely to prescribe PrEP (aPR = 3.57, 95% CI 2.78, 4.55). In addition, PCPs who prescribed nPEP were less likely to be Asian or of other race/ ethnicity (aPR = 0.64, 95% CI 0.44, 0.95), and less likely to be nurse practitioners (aPR = 0.66, 95% CI 0.44, 0.99) than physicians.

3.2. Prescribing PrEP

PCPs who prescribed PrEP were more likely to have a self-reported good understanding of PrEP (aPR = 4.35, 95% CI 2.63, 7.14), more likely to prescribe nPEP (aPR = 5.00, 95% CI 2.00, 12.50), and more likely to provide primary care for PWH (aPR = 1.56, 95% CI 1.06, 2.27) (Table 3).

3.3. Prescribing ART to PWH

Among providers who cared for PWH, PCPs who prescribed ART were more likely to have a self-reported good understanding of nPEP (aPR = 1.89, 95% CI 1.27, 2.78), and more likely to practice in an outpatient public practice versus an inpatient hospital-based facility (aPR = 2.14 95% CI 1.51, 3.04). In addition, PCPs who prescribed ART were less likely to provide care in partnership with an infectious disease physician (aPR = 0.60, 95% CI 0.42, 0.86). (Table 4).

4. Discussion

We examined PCPs' practices prescribing ARVs for prevention in high HIV burden areas of the Southeast. Overall, PCPs reported low levels of prescribing nPEP, PrEP and ART: 31.0%, 18.1% and 27.2%, respectively. In comparison to prior reports, our results showed lower frequency of nPEP prescriptions among PCPs (Rodríguez et al., 2013) while our findings related to PrEP were better aligned with previous studies (Tellalian et al., 2013). We also found that relatively few PCPs who cared for PWH prescribed ART, even when excluding those who collaborated with infectious disease physicians. This finding highlights the potential opportunities to increase the workforce capable of managing HIV infection, which is critically needed to enhance HIV care and reduce transmission risk among PWH in the Southeast (Centers for Disease Control and Prevention, 2018c).

Overall, we found bivariate correlations between nPEP, PrEP and ART prescribing. Our analyses revealed that providers who were *familiar* with one type of ARV for prevention were likely to *prescribe* other types of ARVs for prevention (e.g., those familiar with nPEP were more likely to prescribe ART). Our findings are consistent with other studies that have demonstrated a correlation between promoting a biomedical intervention to prevent HIV infection, such as having written nPEP protocol (Rodríguez et al., 2013) or staff training (Du Mont et al., 2011), and prescribing the intervention itself. Other studies also have shown that attending nPEP and PrEP trainings increased clinicians' comfort with prescribing nPEP and PrEP to patients (Centers for Disease Control and Prevention, 2005; Merchant et al., 2003; Shoptaw et al., 2008). We believe our findings likewise document that familiarity and comfort with how to use ARVs to prevent HIV infection is associated with greater likelihood of using them for this purpose. Therefore, provider trainings that combine nPEP and PrEP content may serve as an efficient strategy to increase overall use of ARVs for HIV prevention in high burden areas in the Southeast.

In addition, patient care seeking behaviors may also contribute to low ARV prescribing among PCPs (specifically nPEP and PrEP); persons who may request ARVs for prevention (i.e., MSM) often perceive stigma from their PCP and not disclose their MSM behavior

(Franks et al., 2018; Mehta et al., 2011). Therefore, patients may opt to seek care at a community health setting (i.e., clinic) (Jain et al., 2015) rather than from their PCP. Sensitivity training that addresses HIV-related stigma are needed for providers and staff to increase their comfort and capacity for providing HIV prevention services (including ARVs) to their patients.

4.1. Prescribing nPEP

Our analyses provided several insights regarding the prescription of nPEP by PCPs in the Southeast. We found that the frequency of having ever prescribed nPEP (~31%) was lower than that reported from HIV specialists (i.e., 40–60%) in other studies (Rodríguez et al., 2013). The differences between what we observed among PCPs sampled compared with HIV specialists were likely attributed to the general clinical context of nPEP initiations. For instance, nPEP is often initiated during emergency care for incidences of sexual assault (Merchant et al., 2003; Krause et al., 2014; Merchant et al., 2008). Most PCPs in our sample did not practice in emergency care settings and were not likely to encounter such types of urgent clinical situation, whereas HIV specialists might be called upon by emergency care providers to provide expert consultation regarding nPEP. Other studies indicate that providers believe that nPEP may lead to antiretroviral resistance (Rodríguez et al., 2013). In addition, low rates of PCPs prescribing nPEP may be a function of the patients' need for immediate care. Patients who fear possible HIV infection from recent consensual sexual encounters are more likely to obtain nPEP more quickly from a community health center (i.e., STI clinic) rather than their PCPs. The relatively low prescription rates of nPEP we observed among PCPs presents an opportunity to inform workforce training and best practices for providing nPEP in the primary care setting.

4.2. Prescribing PrEP

We found that the number of PCPs in the Southeast that reported ever prescribing PrEP to their patients was low, consistent with other studies of PCPs in this region (Petroll et al., 2017). There is substantial opportunity to enhance provider capacity to implement this effective biomedical intervention among PCPs in the Southeast.

4.3. Prescribing ART to PWH

The number of PCPs who ever prescribed ART was also low. Expanding the capacity of Southeast PCPs to provide quality HIV care could substantially increase care in this disproportionately affected region. We found that among PCPs prescribing ART to PWH, a larger proportion practiced in outpatient public clinics (e.g., community health centers, federally qualified health centers) than inpatient hospital-based facilities. This finding may reflect the evolution of HIV infection as a chronic illness (Department of Health and Human Services, 2016), and evolving models of HIV care that emphasize integration with primary care (Chu et al., 2010; Lundgren, 2014). We surmise that PCPs who work with infectious disease (ID) physicians would less likely prescribe ART, since those ID physicians would likely be the providers who prescribe ART.

The National HIV/AIDS Strategy (The White House Office of National AIDS Policy, 2015) and federally-funded demonstration projects (Centers for Disease Control and Prevention,

2016a,b, 2017) promote coordinated HIV care via organizational collaborations across federal, state, and local public health entities to work with clinical care and other service support providers. However, reports have documented the challenges associated with implementing such models (Williams et al., 2018; Kimmel et al., 2016). Our findings suggest PCPs could benefit from more education about use of ARVs for prevention such as through collaborations with local health organizations and thereby improve coordinated care, particularly within jurisdictions located in the Southeast.

4.4. Limitations and strengths

The 29.6% adjusted response rate may seem low compared with other studies, including those in the field of HIV (Beer et al., 2016; Goyal et al., 2013; O'Leary et al., 2016). However, our study's response rate was well within the realm of surveys with samples of providers whom had not been engaged in research prior to this study (Jensen et al., 2017; McManus et al., 2014; Shirts et al., 2009; Ward et al., 2011). We also found that non-respondents were more likely to be physicians or from the Miami MSA. However, the data weighting process adjusts for these response differences. We also did not collect patient or facility level data from medical chart abstractions or any other independent data source aside from providers' recall and general knowledge.

Our measure of having prescribed ART was originally designed to assess respondents' knowledge of when it is appropriate to first prescribe. Rescoring the measure into dichotomous categories may have introduced measurement error and we caution regarding broad extrapolation of these findings.

Despite limitations, our study represents one of the first efforts to examine the prescribing practices of a representative sample of PCPs in the Southeast with regard to the use of ARVs for prevention. Our sampling approach provided an accurate estimate of the population of providers within the selected MSAs. Based on the study sample's representativeness, our results can inform regional HIV prevention strategies to increase the dissemination and uptake of these effective ARVs for prevention tools.

5. Conclusion

Our study highlights the extent and correlates of nPEP, PrEP and ART prescription among a selection of PCPs in the Southeast. We found that prescription of nPEP and PrEP was relatively low, especially given the region's disproportionate burden of HIV infections. These data together with ART prescribing practices among PCPs highlight an opportunity to expand the reach of HIV prevention and care. In addition, our findings can inform activities to reduce disparities in biomedical prevention tools uptake and HIV incidence among African Americans in the South, particularly those who are MSM. Future research and programmatic efforts could leverage factors associated with prescribing ARVs (including nPEP and PrEP) for HIV prevention.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1

Characteristics, knowledge, and clinical practices of primary care providers in selected southern states—Knowledge, Behaviors, Attitudes and Practices of HIV-Related Care among Providers in the Southeast (K-BAP) Study, 2017 (n= 820).

Characteristic	Raw[a] N (N = 820)	Weighted %
Gender		
Female	543	59.4
Male	198	40.6
Race & ethnicity		
White (non-Hispanic/Latino)	488	60.2
Black (non-Hispanic/Latino)	93	10.8
Hispanic/Latino	42	9.1
Asian (non-Hispanic/Latino)	85	18.7
Other	14	1.2
Provider type		
Physician	367	75.6
Nurse practitioner	296	20.7
Physician assistant	157	3.6
Age (years)		
<40	251	26.9
40–49	203	23.4
50–59	158	25.8
≥60	122	23.9
MSA		
Atlanta	176	20.3
DC & Baltimore	344	47.6
Miami	88	23.2
Baton Rouge & New Orleans	212	8.8
Years practicing as board-certified provider		
<1–5	168	22.5
6–10	175	23.5
11–20	224	30.1
≥21	178	23.9
Previous HIV-related training		
Yes	273	36.3
No	511	63.7
Familiarity with nPEP		
Self-reported good understanding of concept	420	48.5
Know little about it/never heard of it	345	51.5
Familiarity with PrEP		
Self-reported good understanding of concept	272	41.9

Characteristic	Raw[a] N (N = 820)	Weighted %
Know little about it/never heard of it	490	52.1
Ever prescribed nPEP		
Yes	175	31.0
No	554	69.0
Ever prescribed PrEP		
Yes	114	18.1
No	626	81.9
Ever prescribed ART to PWH		
Yes	125	27.2
No	334	72.8
Provided primary care to PWH[a]		
Yes	163	43.1
No	295	56.9
Provided care in partnership with an ID physician?		
Yes	123	75.9
No	39	24.1
Setting where you practice medicine (> 50% of time)		
Academic	29	3.8
Outpatient: Public	85	8.9
Outpatient: Private	254	37.7
Inpatient/hospital-based	315	33.9
Other	124	15.6

MSA = metropolitan statistical area; DC= District of Columbia; nPEP = nonoccupational post-exposure prophylaxis; PrEP = pre-exposure prophylaxis; ART = antiretroviral therapy; PWH =persons with HIV; ID = infectious disease.

[a]Due to missing values, not all categories have the same denominator.

Table 2

Model of prescribing non-occupational post-exposure prophylaxis among primary care providers in selected southern states—Knowledge, Behaviors, Attitudes and Practices of HIV-Related Care among Providers in the Southeast (K-BAP) Study, 2017 (n=820).

Characteristic	nPEP		Rao-Scott χ^2	PR (95% CI)	aPR (95% CI)
	Yes n (Prev. %)	No n (Prev. %)			
Gender			0.0001		
Female	103 (22.8)	440 (77.2)		Ref.	Ref.
Male	68 (36.9)	130 (63.1)		1.62 (1.23, 2.23)	1.04 (0.77, 1.40)
Race & ethnicity			0.0001		
White (non-Hispanic/Latino)	117 (31.8)	371 (68.2)		Ref.	Ref.
Black (non-Hispanic/Latino)	20 (23.4)	73 (76.6)		0.74 (0.55, 0.98)	0.81 (0.61, 1.09)
Hispanic/Latino	12 (38.8)	30 (61.2)		1.22 (0.92, 1.62)	1.15 (0.95, 1.41)
Asian/other	19 (18.4)	80 (81.6)		0.58 (0.40, 0.84)	0.64 (0.44, 0.95)
Provider type			0.0001		
Physician	100 (33.1)	235 (66.9)		Ref.	Ref.
Nurse practitioner	44 (15.7)	237 (84.3)		0.47 (0.35, 0.65)	0.66 (0.44, 0.99)
Physician assistant	31 (21.8)	118 (78.2)		0.66 (0.41, 1.07)	0.69 (0.45, 1.06)
Age (years)			0.9755		
< 40	58 (29.5)	193 (70.5)			
40–49	46 (30.0)	161 (70.0)			
50–59	39 (27.5)	120 (72.5)			
>60	30 (30.4)	92 (69.6)			
MSA			0.0137		
Atlanta	35 (26.5)	135 (73.5)		Ref.	
DC & Baltimore	70 (25.8)	249 (74.2)		0.97 (0.59, 1.59)	
Miami	23 (39.1)	55 (60.9)		1.48 (0.80, 2.73)	
Baton Rouge & New Orleans	47 (25.4)	151 (74.6)		0.96 (0.53, 1.74)	
Years practicing as board-certified provider			0.7185		
< 1–5	36 (32.0)	119 (68.0)			
6–10	36 (28.4)	127 (71.6)			

Characteristic	nPEP		Rao-Scott χ^2	PR (95% CI)	aPR (95% CI)
	Yes n (Prev. %)	No n (Prev. %)			
11–20	56 (31.6)	161 (68.4)			
>21	37 (24.8)	134 (75.2)			
Previous HIV-related training			0.0009		
Yes	87 (41.2)	174 (58.8)		1.82 (1.16, 2.85)	1.15 (0.81, 1.64)
No	88 (22.5)	409 (77.5)		Ref.	Ref.
Familiarity with nPEP			0.0001		
Self-reported good understanding of concept	141 (45.6)	204 (54.4)		4.00 (1.89, 8.33)	2.63 (1.59, 4.35)
Know little about it/never heard of it	34 (11.3)	386 (88.7)		Ref.	Ref.
Familiarity with PrEP			0.0002		
Self-reported good understanding of concept	110 (44.4)	162 (55.6)		2.50 (1.41, 4.35)	0.79 (0.50, 1.27)
Know little about it/never heard of it	65 (17.9)	425 (82.1)		Ref.	Ref.
Ever prescribed PrEP			0.0001		
Yes	76 (75.0)	38 (25.0)		3.85 (3.45, 4.35)	3.57 (2.78, 4.55)
No	99 (19.3)	549 (80.7)		Ref.	Ref.
Ever prescribed ART to PWH[a]			0.27		
Yes	50 (33.1)	108 (66.9)			
No	121 (27.9)	465 (72.1)			
Provided primary care for PWH			0.5578		
Yes	64 (40.7)	99 (59.3)			
No	73 (37.5)	222 (62.5)			
Provided care in partnership with an ID physician?			0.2757		
Yes	45 (35.8)	78 (64.2)			
No	19 (55.5)	20 (44.5)			
Setting where you practice medicine (> 50% of time)			0.0016		
Academic	10 (47.7)	19 (52.3)		1.18 (0.83, 1.68)	0.78 (0.39, 1.54)
Outpatient: Public	24 (37.6)	56 (62.4)		0.93 (0.67, 1.29)	0.97 (0.63, 1.48)
Outpatient: Private	42 (18.0)	202 (82.0)		0.45 (0.26, 0.77)	0.57 (0.34, 0.95)
Inpatient/hospital-based	78 (40.3)	217 (59.7)		Ref.	Ref.

Characteristic	nPEP		Rao-Scott χ^2	PR (95% CI)	aPR (95% CI)
	Yes n (Prev. %)	No n (Prev. %)			
Other	21 (22.7)	92 (77.3)		0.56 (0.26, 1.22)	0.83 (0.49, 1.38)

nPEP = non-occupational post-exposure prophylaxis; PR =prevalence ratio; CI = confidence interval; aPR= adjusted prevalence ratio; MSA = metropolitan statistical area; DC =District of Columbia; PrEP =pre-exposure prophylaxis; ART =antiretroviral therapy; PWH = persons with HIV; ID= infectious disease.

[a]Includes responses from entire study sample.

Table 3

Model of prescribing pre-exposure prophylaxis among primary care providers in selected southern states—Knowledge, Behaviors, Attitudes and Practices of HIV-Related Care among Providers in the Southeast (K-BAP) Study, 2017 (n= 820).

Characteristic	PrEP		Rao-Scott χ^2	PR (95% CI)	aPR (95% CI)
	Yes n (Prev. %)	No n (Prev. %)			
Gender			0.0005		
Female	74 (13.6)	469 (86.4)		Ref.	Ref.
Male	38 (23.3)	160 (76.7)		1.71 (1.18, 2.48)	1.24 (0.56, 2.73)
Race & ethnicity			0.3515		
White (non-Hispanic/Latino)	78 (18.4)	410 (81.6)			
Black (non-Hispanic/Latino)	15 (19.5)	78 (80.5)			
Hispanic/Latino	6 (13.9)	36 (86.1)			
Asian/other	12 (15.1)	87 (84.9)			
Provider type			0.001		
Physician	62 (19.4)	272 (80.6)		Ref.	Ref.
Nurse practitioner	31 (11.1)	248 (88.9)		0.57 (0.38, 0.85)	1.09 (0.56, 2.14)
Physician assistant	21 (14.5)	128 (85.5)		0.75 (0.48, 1.15)	1.19 (0.83, 1.70)
Age (years)			0.8717		
<40	44 (18.1)	207 (81.9)			
40–49	25 (15.0)	182 (85.0)			
50–59	28 (19.4)	131 (80.6)			
≥60	16 (17.3)	106 (82.7)			
MSA			0.2465		
Atlanta	22 (14.0)	147 (86.0)			
DC & Baltimore	50 (18.8)	268 (81.2)			
Miami	11 (18.6)	67 (81.4)			
Baton Rouge & New Orleans	31 (16.5)	166 (83.5)			
Years practicing as board-certified provider			0.0503		
<1–5	31 (27.4)	124 (72.6)			
6–10	17 (8.0)	146 (92.0)			

Characteristic	PrEP		Rao-Scott χ^2	PR (95% CI)	aPR (95% CI)
	Yes n (Prev. %)	No n (Prev. %)			
11–20	32 (17.6)	183 (82.4)			
≥21	25 (17.7)	146 (82.3)			
Previous HIV-related training			0.0001		
Yes	69 (29.4)	192 (70.6)		2.63 (1.67, 4.17)	0.90 (0.56, 1.43)
No	45 (11.1)	449 (88.9)		Ref.	Ref.
Familiarity with nPEP			0.1203		
Self-reported good understanding of concept	88 (23.0)	257 (77.0)			
Know little about it/never heard of it	26 (11.7)	391 (88.3)			
Familiarity with PrEP			0.0001		
Self-reported good understanding of concept	102 (36.1)	170 (63.9)		9.09 (3.57, 25.00)	4.35 (2.63, 7.14)
Know little about it/never heard of it	12 (4.1)	478 (95.9)		Ref.	Ref.
Ever prescribed nPEP			0.0001		
Yes	76 (45.2)	99 (54.8)		7.14 (4.55, 11.11)	5.00 (2.00, 12.50)
No	38 (6.2)	549 (93.8)		Ref.	Ref.
Ever prescribed ART to PWH[a]					
Yes	47 (28.1)	111 (71.9)		1.96 (0.98, 3.85)	
No	67 (14.4)	519 (85.6)		Ref.	
Provided primary care for PWH			0.0134		
Yes	56 (31.2)	107 (68.8)		1.82 (1.08, 3.13)	1.56 (1.06, 2.27)
No	29 (17.0)	266 (83.0)		Ref.	Ref.
Provided care in partnership with an ID physician?			0.1402		
Yes	37 (22.3)	86 (77.7)			
No	18 (48.2)	21 (51.8)			
Setting where you practice medicine (> 50% of time)			0.0599		
Academic	13 (42.9)	16 (57.1)			
Outpatient: Public	22 (25.5)	57 (74.5)			
Outpatient: Private	33 (13.7)	210 (86.3)			
Inpatient/hospital-based	35 (20.0)	259 (80.0)			

Characteristic	PrEP		Rao-Scott χ^2	PR (95% CI)	aPR (95% CI)
	Yes n (Prev. %)	No n (Prev. %)			
Other	11 (10.4)	102 (89.6)			

PrEP = pre-exposure prophylaxis; PR =prevalence ratio; CI = confidence interval; aPR = adjusted prevalence ratio; MSA = metropolitan statistical area; DC =District of Columbia; nPEP = non-occupational post-exposure prophylaxis; ART = antiretroviral therapy; PWH = persons with HIV; ID =infectious disease.

[a]Includes responses from entire study sample.

Table 4

Model of prescribing antiretroviral therapy to persons with HIV among primary care providers who provide care for persons with HIV in selected southern states—Knowledge, Behaviors, Attitudes and Practices of HIV-Related Care among Providers in the Southeast (K-BAP) Study, 2017 (n = 458).

Characteristic	ART to PWH[a]		Rao-Scott χ^2	PR (95% CI)	aPR (95% CI)
	Yes n (Prev. %)	No n (Prev. %)			
Gender					
Female	73 (25.6)	237 (74.4)	0.04	Ref.	Ref.
Male	49 (39.9)	94 (60.1)		1.56 (0.95, 2.57)	1.39 (0.97, 1.99)
Race & ethnicity			0.11		
White (non-Hispanic/Latino)	70 (26.4)	223 (73.6)			
Black (non-Hispanic/Latino)	20 (35.6)	40 (64.4)			
Hispanic/Latino	8 (42.0)	17 (58.0)			
Asian/other	21 (43.9)	42 (56.1)			
Provider type			0.0001		
Physician	70 (37.2)	127 (62.8)		Ref.	Ref.
Nurse practitioner	32 (20.9)	124 (79.1)		0.56 (0.37, 0.84)	0.85 (0.45, 1.62)
Physician assistant	23 (22.5)	83 (77.5)		0.61 (0.37, 0.99)	0.73 (0.44, 1.22)
Age (years)			0.50		
< 40	48 (31.8)	126 (68.2)			
40–49	26 (26.4)	89 (73.6)			
50–59	32 (42.1)	58 (57.9)			
>60	16 (30.7)	54 (69.3)			
MSA					
Atlanta	21 (21.1)	90 (78.9)	0.0001	Ref.	Ref.
DC & Baltimore	53(35.4)	125 (64.6)		1.68 (1.07, 2.63)	1.16 (0.68, 2.00)
Miami	17 (41.4)	31 (58.6)		1.96 (1.68, 2.30)	1.30 (1.00, 1.68)
Baton Rouge & New Orleans	34 (30.8)	88 (69.2)		1.46 (0.97, 2.18)	1.28 (0.85, 1.91)
Years practicing as board-certified provider			0.04		
< 1–5	32 (35.2)	81 (64.8)		0.76 (0.45, 1.26)	1.02 (0.82, 1.27)
6–10	19 (24.1)	74 (75.9)		0.52 (0.37, 0.71)	0.70 (0.32, 1.55)

Characteristic	ART to PWH[a]		Rao-Scott χ^2	PR (95% CI)	aPR (95% CI)
	Yes n (Prev. %)	No n (Prev. %)			
11–20	34 (26.1)	93 (73.9)		0.56 (0.30, 1.04)	0.83 (0.49, 1.38)
>21	32 (46.6)	61 (53.4)		Ref.	Ref.
Previous HIV-related training			0.04		
Yes	78 (43.3)	106 (56.7)		1.67 (0.97, 2.86)	1.18 (0.59, 2.33)
No	46 (26.1)	228 (73.9)		Ref.	Ref.
Familiarity with nPEP					
Self-reported good understanding of concept	90 (42.7)	151 (57.3)	0.0001	2.33 (1.47, 3.70)	1.89 (1.27, 2.78)
Know little about it/never heard of it	35 (20.0)	183 (80.0)		Ref.	Ref.
Familiarity with PrEP			0.0001		
Self-reported good understanding of concept	82 (48.8)	109 (51.2)		2.70 (1.79, 4.00)	1.47 (0.75, 2.94)
Know little about it/never heard of it	43 (18.1)	225 (81.9)		Ref.	Ref.
Ever prescribed nPEP			0.04		
Yes	46 (32.6)	90 (67.4)		0.98 (0.67, 1.43)	0.57 (0.32, 1.03)
No	79 (33.8)	244 (66.2)		Ref.	Ref.
Ever prescribed PrEP			0.05		
Yes	44 (48.7)	81 (28.7)		1.69 (0.97, 2.94)	1.35 (0.48, 3.85)
No	42 (51.3)	292 (71.3)		Ref.	Ref.
Provided care in partnership with an ID physician?			0.02		
Yes	52 (45.7)	68 (54.3)		0.66 (0.48, 0.91)	0.60 (0.42, 0.86)
No	22 (69.0)	17 (31.0)		Ref.	Ref.
Setting where you practice medicine (> 50% of time)			0.001		
Academic	4 (52.3)	8 (47.7)		2.08 (1.40, 3.09)	2.01 (1.13, 3.58)
Outpatient: Public	26 (58.1)	26 (41.9)		2.30 (1.55, 3.42)	2.14 (1.51, 3.04)
Outpatient: Private	30 (35.7)	81 (64.3)		1.42 (1.05, 1.92)	1.33 (1.01, 1.75)
Inpatient/hospital-based	51 (25.2)	161 (74.8)		Ref.	Ref.
Other	14 (29.0)	57 (71.0)		1.15 (0.56, 2.36)	1.38 (0.77, 2.46)

ART =antiretroviral therapy; PWH = persons with HIV; PR =prevalence ratio; CI = confidence interval; aPR =adjusted prevalence ratio; MSA = metropolitan statistical area; DC= District of Columbia; nPEP =non-occupational post-exposure prophylaxis; PrEP= pre-exposure prophylaxis; ID =infectious disease.

[a]Excluded from adjusted model due to high correlation with prescribing ART.