11-1-2022

Human immunodeficiency virus pre-exposure prophylaxis knowledge, attitudes, and self-efficacy among family planning providers in the Southern United States: Bridging the gap in provider training

Aditi Ramakrishnan

Jessica M Sales

Micah McCumber

Leah Powell

Anandi N Sheth

Open Forum Infectious Diseases

MAJOR ARTICLE

Human Immunodeficiency Virus Pre-Exposure Prophylaxis Knowledge, Attitudes, and Self-Efficacy Among Family Planning Providers in the Southern United States: Bridging the Gap in Provider Training

Aditi Ramakrishnan,[1] Jessica M. Sales,[2] Micah McCumber,[3] Leah Powell,[2] and Anandi N. Sheth[4]

[1]Division of Infectious Diseases, Washington University School of Medicine, St. Louis, Missouri, USA, [2]Department of Behavioral, Social and Health Education Sciences, Rollins School of Public Health, Emory University, Atlanta, Georgia, USA, [3]Department of Biostatistics, Collaborative Studies Coordinating Center, University of North Carolina at Chapel Hill, Chapel Hill, North Carolina, USA, and [4]Division of Infectious Diseases, Emory University School of Medicine, Atlanta, Georgia, USA

Background. Pre-exposure prophylaxis (PrEP) is an effective human immunodeficiency virus (HIV) prevention intervention, but its access and use are suboptimal, especially for women. Healthcare providers provision of PrEP is a key component of the *Ending the HIV Epidemic* initiative. Although training gaps are an identified barrier, evidence is lacking regarding how to tailor trainings for successful implementation. Title X family planning clinics deliver safety net care for women and are potential PrEP delivery sites. To inform provider training, we assessed PrEP knowledge, attitudes, and self-efficacy in the steps of PrEP care among Title X providers in the Southern United States.

Methods. We used data from providers in clinics that did not currently provide PrEP from a web-based survey administered to Title X clinic staff in 18 Southern states from February to June 2018. We developed generalized linear mixed models to evaluate associations between provider-, clinic-, and county-level variables with provider knowledge, attitudes, and self-efficacy in PrEP care, guided by the Consolidated Framework for Implementation Research.

Results. Among 351 providers from 193 clinics, 194 (55%) were nonprescribing and 157 (45%) were prescribing providers. Provider ability to prescribe medications was significantly associated PrEP knowledge, attitudes, and self-efficacy. Self-efficacy was lowest in the PrEP initiation step of PrEP care and was positively associated with PrEP attitudes, PrEP knowledge, and contraception self-efficacy.

Conclusions. Our findings suggest that PrEP training gaps for family planning providers may be bridged by addressing unfavorable PrEP attitudes, integrating PrEP and contraception training, tailoring training by prescribing ability, and focusing on the initiation steps of PrEP care.

Keywords. HIV prevention; implementation science; PrEP; provider education; women's health.

INTRODUCTION

The Southern United States has the highest burden of human immunodeficiency virus (HIV) compared to other US regions [1]. Women comprise 20% of the 40 000 annual new diagnoses, the majority of whom live in the South [1, 2]. Human immunodeficiency virus pre-exposure prophylaxis (PrEP) is a safe, effective, individual-controlled, and scalable HIV prevention strategy that is a key initiative in the Department of Health and Human Services (DHHS) "Ending the HIV Epidemic: A Plan for America" [3, 4]. Despite national efforts for widespread PrEP dissemination, uptake remains disproportionately low in in the South [1] and among women, only 10% of whom who could benefit from PrEP were prescribed in 2019 [5–7].

The Ending the HIV Epidemic initiative emphasizes optimizing the HIV workforce through partnerships with diverse organizations and healthcare provider training [4], which is a necessary preimplementation step. However, few US PrEP implementation studies have focused on provider training needs [8] or considered women's health providers [9], who face key challenges to scaling PrEP. Structural barriers include low risk-perception and awareness of PrEP among women [10–13] and scarcity of PrEP-providing clinics and insurance support for PrEP, particularly in the South [5, 14, 15]. Provider-level barriers include variable knowledge and attitudes towards PrEP

Received 05 August 2022; editorial decision 05 October 2022; accepted 14 October 2022; published online 17 October 2022

Correspondence: Anandi N. Sheth, MD, MSc, Division of Infectious Diseases, Emory University School of Medicine, 49 Jesse Hill Jr. Drive, Atlanta, GA 30303, USA (ansheth@emory.edu).

Open Forum Infectious Diseases®

https://doi.org/10.1093/ofid/ofac536

among primary care providers, HIV clinicians, and family planning (FP) providers [16–19]. Knowledge about PrEP and likelihood of PrEP prescribing have also been found to be lower among providers in the South compared to providers in other regions [8, 16, 17, 20].

The Consolidated Framework for Implementation Research (CFIR) [21] can be applied to assess factors that may influence provider PrEP training and implementation. Within the CFIR domain, "Characteristics of Individuals," 3 key constructs relevant to PrEP training include the following: knowledge about PrEP, attitudes towards PrEP, and self-efficacy in PrEP care (ie, confidence in conducting the steps of PrEP care). The Title X Family Planning Program provides funding to support a diverse network of clinics that serve as a safety net source of healthcare for women, particularly in areas without Medicaid expansion [14], and are potential PrEP delivery sites. The diversity of Title X-funded clinics may lead to variable models of PrEP care [22], thus tailoring trainings based on assessment of these CFIR constructs may be particularly relevant for PrEP scale-up in this setting. However, effective strategies to improve provider provision of PrEP in women's health settings are unknown.

We recently conducted a CFIR-guided survey of providers and administrators from Title X clinics in the South to systematically study facilitators and barriers to implementation of PrEP in this setting [14]. In this secondary analysis of the parent survey, our objectives are to assess the associations between provider-, clinic-, and county-level covariates, and the CFIR constructs of provider knowledge, attitudes, and self-efficacy in PrEP care, with the overall goal of informing how to tailor PrEP training for FP providers in the Southern United States.

METHODS

Study Design and Population

The parent study's protocol, recruitment strategies, data collection instruments, and statistical analysis methods have been previously described [23]. In brief, we conducted a web-based, geographically targeted survey of healthcare providers and clinic administrators from Title X clinics in 18 Southern states between February and June 2018 (DHHS regions III [Mid-Atlantic: Washington DC, Delaware, Maryland, Pennsylvania, Virginia, West Virginia], IV [Southeast: Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee], and VI [Southwest: Arkansas, Louisiana, New Mexico, Oklahoma, Texas]). Participants were recruited online through the National Clinical Training Center for Family Planning (NCTCFP), in-person at the NCTCFP meeting, and through engagement with state Title X grantees. Surveys completed by respondents outside of the designated Title X DHHS regions were excluded (13 of 755), and only surveys in which the participant responded to the question of PrEP use in the clinic were included ($n = 519$). As part of evaluating clinic readiness to implement PrEP [14], the parent survey addressed various CFIR domains including Characteristics of Individuals, which comprised the constructs of provider knowledge, attitudes, and self-efficacy in PrEP care. The parent survey was created so that only respondents from non-PrEP providing clinics completed certain survey items; therefore, only non-PrEP providing clinic providers (defined as any clinical staff who could screen, counsel, or prescribe PrEP) were included in this analysis. This methodology was aligned with our overarching goal of understanding best practices for provider training to facilitate PrEP delivery. Approval was obtained from the Emory University and University of North Carolina Institutional Review Boards.

Survey Measures

Measures were selected from the 93-item parent survey [14, 23]. Survey items were adapted from existing measures of CFIR constructs (ie, implementation climate, leadership engagement, PrEP knowledge, and PrEP attitudes) [17, 23–27] or developed by the study team using CFIR-specific tools to assess CFIR constructs relevant to PrEP implementation (ie, for self-efficacy) [21] (Supplemental Figure 1).

The primary outcomes of this analysis were the CFIR-guided constructs of PrEP knowledge, PrEP attitudes, and self-efficacy in PrEP care. Outcome measures were derived as semicontinuous composite scores based on collections of related survey items. Survey items had high internal consistency based on Cronbach's Alpha [14]. Survey questions assessing knowledge were based on a previously published survey of PrEP knowledge and attitudes among FP providers [17], and this consisted of 5 multiple choice questions addressing PrEP medication identification, efficacy in clinical trials, HIV testing, frequency of monitoring patients taking PrEP, and frequency of monitoring side-effects and laboratories for patients taking PrEP. The summary score for PrEP knowledge was derived as the mean sum of correct responses (range, 0–5). Other CFIR-related survey items were evaluated on a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree). Survey items addressing attitudes towards PrEP were divided topically into the following subcategories: (1) "Acceptability of PrEP Integration in FP Settings" and (2) "Clinical and Socio-behavioral Attitudes towards PrEP". The summary score for PrEP attitudes was calculated as the average of survey items (range, 0–5). Higher Likert-scale scores for positively worded questions indicated more favorable attitudes towards PrEP, and for negatively worded questions they indicated more unfavorable attitudes towards PrEP. Certain survey items were recoded for the same directionality when deriving the overall score. Self-efficacy was evaluated through survey questions on confidence in addressing each step of PrEP care: "PrEP Screening"

(comprising patient engagement and initial clinical evaluation), "PrEP Initiation", and "PrEP Follow-up" [27, 28]. The summary score was calculated as the average of all self-efficacy survey items and subcategorized into these steps of PrEP care.

Provider-, clinic-, and county-level characteristics were selected as covariates a priori based on review of the literature. Provider-level covariates included age, gender (female vs other), self-reported race (White vs non-White), ethnicity (Latinx vs non-Latinx), years worked in clinic role, ability to prescribe medication (yes with or without a supervisor vs no), and "contraception self-efficacy"—the summary score of 5-point Likert survey items addressing confidence in conducting family planning care (Table 2). Clinic-level covariates included clinic type (health department, federally qualified health center, or other), onsite insurance assistance (yes vs no), onsite pharmacy (yes vs no), and offering primary care services (yes vs no). County-level covariates for the population of the clinic catchment area included HIV prevalence rate, percentage uninsured, percentage living in poverty, percentage with a high school degree, percentage Hispanic/Latinx, percentage of reproductive-age females, Medicaid expansion (yes vs no), and DHHS Title X region based on county-level AIDSVu and Census data using the geocoded address of the provider's clinic [29, 30]. Because data from counties with a small number of HIV cases and/or a small population size are suppressed in AIDSVu, for analysis we recoded suppressed values to the smallest positive HIV prevalence rate across the dataset. Using the 2013 NCHS urban-rural classification scheme, clinics were classified as metropolitan (ie, urban, including large central or fringe metro, medium metro, and small metro areas) and nonmetropolitan (ie, rural, including micropolitan and noncore counties) [31].

Statistical Analyses

Statistical analyses were performed using SAS version 9.4 (SAS Software, Cary, NC). Variables were summarized with descriptive statistics (means [standard deviation {SD}] or counts [%] for all providers and/or clinics where appropriate). We applied χ^2 and t tests, where appropriate, to compare PrEP knowledge, attitudes, and self-efficacy scores between prescribing and nonprescribing providers. Paired t tests were applied to compare mean scores between the self-efficacy steps of PrEP care.

We first used simple linear regression to evaluate associations between each provider-, clinic-, and county-level covariate and each CFIR outcome. All covariates with $P < .2$ were included in the multivariable models. Next, generalized linear mixed models that included a clinic-specific random effect were developed for each outcome. If covariates were collinear ($r > 0.8$), then only 1 relevant covariate was retained. Log transformation was applied to covariates that did not have a normal distribution. Backward selection was applied (threshold $P < .2$) to develop reduced linear mixed models, which were compared with the full models to assess consistency. Given potential heterogeneity in provider experience based on prescribing, models for each outcome were then stratified by prescriber status. Missing data were uncommon and observations were dropped from the models if data were incomplete. Analyses were restricted to respondents who responded to at least 1 survey item pertaining to that outcome. Statistical tests were deemed significant for $P < .05$.

Patient Consent Statement

Participant written consent was obtained, and design of this work was approved by Emory University and University of North Carolina Institutional Review Boards.

RESULTS

Overall, 519 providers and administrators from 283 unique clinics completed the parent survey. After excluding responses from administrators and those from PrEP providing clinics, 351 providers from 193 unique non-PrEP clinics were included in this secondary analysis. The mean age was 45 (11.9%) years, 310 (88%) were female, and 228 (65%) were White (Table 1). Providers had worked in their respective clinics for a mean duration of 8.1 (SD = 8.33) years, and 157 (45%) could prescribe medications with or without supervision (prescribing providers). Nonprescribing providers consisted of 131 (63%) nurses and 65 (31%) other clinical staff (health educators, counselors, medical assistants, or patient navigators).

Regarding clinic-level characteristics, 346 (70%) survey respondents were from the Southeast DHHS region, 244 (70%) were from clinics located in metropolitan areas, and 279 (79%) were from clinics classified as health departments. One hundred twenty-three (35%) respondents noted that their clinics provided primary care services, 227 (65%) endorsed that their clinics had onsite insurance assistance, and 158 (45%) reported that their clinics had a pharmacy onsite. At the county level, 113 (32%) respondents were from clinics located in catchment areas of Medicaid expansion. County HIV prevalence rate was a median 290 per 100 000 population.

Knowledge About Pre-Exposure Prophylaxis

The mean sum of correct responses for knowledge survey items (of 5) was 2.6 (SD = 1.72) and higher for prescribing versus nonprescribing providers ($P < .0001$) (Supplemental Table 1). Unadjusted associations between provider-, clinic-, and county-level covariates and PrEP knowledge are shown in Supplemental Table 2. In the overall adjusted model, PrEP knowledge was positively associated with prescribing ability (0.851; 95% confidence interval [CI], 0.493–1.209) and negatively associated with years worked in clinic role (−0.031; 95% CI: −.053 to −0.010) (Figure 1, Supplemental Table 3).

Table 1. Provider-, Clinic-, and County-Level Characteristics of Survey Respondents From Title X Family Planning Clinics in the Southern United States That Did Not Provide PrEP, by Ability to Prescribe Medications

Variable	All Providers ($n = 351$)	Prescribing Providers[a] ($n = 157$)	Nonprescribing Providers[b] ($n = 194$)
Provider-Level Characteristics			
Age (in Years), Mean (SD)	45.32 (11.93)	47.2 (12.78)	43.71 (10.94)
Gender, *n* (%)			
Male	3 (1.0)	0 (0)	3 (1.8)
Female	310 (98.7)	142 (99.3)	168 (98.2)
Genderqueer	1 (0.3)	1 (0.7)	0 (0)
Nonbinary	0 (0)	0 (0)	0 (0)
Ethnicity, *n* (%)			
Latino/Latina/Latinx	12 (3.9)	3 (2.2)	9 (5.3)
Not Latino/Latina/Latinx	296 (96.1)	135 (97.8)	162 (94.7)
Race, *n* (%)			
Asian/Pacific Islander	6 (2.0)	4 (2.8)	2 (1.2)
Black/African American	57 (18.6)	19 (13.5)	38 (22.5)
Native American/Alaskan Native	1 (0.3)	4 (2.8)	1 (0.6)
White	228 (74.5)	111 (78.7)	117 (69.2)
Other	3 (1.0)	0 (0)	3 (1.8)
More than 1 Race	11 (3.6)	3 (1.6)	8 (4.7)
Primary role(s) at clinic[c] *n* (%)			
Clinical Provider (NP, CNM, PA, MD, DO)	157 (44.7)	157 (100)	0 (0)
Nurse	157 (44.7)	26 (16.6)	131 (67.5)
Health Educator, Counselor, Health Care	69 (19.7)	4 (2.5)	65 (33.5)
Associate, Medical Assistant, or Patient Navigator			
Other Provider	7 (2.0)	1 (0.6)	6 (3.1)
Other Administrator	13 (3.7)	8 (5.1)	5 (2.6)
Years Worked in Clinic Role, Mean (SD)	8.12 (8.33)	8.46 (7.88)	7.85 (8.70)
Clinic-Level Characteristics			
Location, *n* (%)			
Metropolitan	244 (69.5)	116 (73.9)	128 (66.0)
Nonmetropolitan	107 (30.5)	41 (26.1)	66 (34.0)
Primary Care Services Provided at clinic, *n* (%)			
Yes	123 (35.0)	49 (31.2)	89 (45.9)
No	228 (65.0)	74 (38.1)	105 (54.1)
Staff to Assist Patients Enrolling in Medicaid and Insurance Programs, *n* (%)			
Yes	227 (64.7)	107 (68.2)	120 (61.9)
No/Unknown	124 (35.3)	50 (31.9)	74 (38.1)
Respondent's Clinic has A Pharmacy on Site, *n* (%)			
Yes	158 (45.3)	69 (44.5)	89 (45.9)
No/Unknown	191 (54.7)	86 (55.5)	105 (54.1)
Clinic Type, *n* (%)			
Family Planning	8 (2.3)	6 (3.8)	2 (1.0)
Health Department	279 (79.7)	114 (72.6)	165 (85.5)
Hospital	20 (5.7)	15 (9.6)	5 (2.6)
Planned Parenthood	2 (0.6)	2 (1.3)	0 (0)
Federally Qualified Health Center	27 (7.7)	12 (7.6)	15 (7.8)
Community	7 (2.0)	4 (2.5)	3 (1.6)
School	5 (1.4)	3 (1.9)	2 (1.0)
Other	2 (0.6)	1 (0.6)	1 (0.5)
Clinic Title x Region, *n* (%)			
Region III (Mid-atlantic)	72 (20.5)	43 (27.4)	29 (15.0)
Region IV (Southeast)	246 (70.1)	97 (61.8)	149 (76.8)
Region VI (Southwest)	33 (9.4)	17 (10.8)	16 (8.3)
County-Level Characteristics			
Medicaid Expansion[d], *n* (%)			
Yes	113 (32.2)	61 (38.9)	52 (26.8)
No	238 (67.8)	96 (61.2)	142 (73.2)

Table 1. Continued

Variable	All Providers (*n* = 351)	Prescribing Providers[a] (*n* = 157)	Nonprescribing Providers[b] (*n* = 194)
HIV Prevalence Rate (Per 100 000 Population), Median (IQR)	289.5 (351.0)	347.5 (397.5)	259.0 (365.0)
Reproductive-Age Women (15–44 Years) (%), Mean (SD)	20.18 (3.12)	20.73 (3.57)	19.73 (2.60)
Hispanic or Latinx (%), Mean (SD)	5.90 (6.10)	7.10 (5.60)	5.50 (4.60)
White Race (%), Mean (SD)	68 (18.93)	69.68 (17.60)	66.66 (19.89)
Black Race (%), Mean (SD)	23.36 (18.61)	20.94 (16.85)	25.32 (19.75)
Uninsured (%), Mean (SD)	12.73 (3.42)	12.25 (3.62)	13.12 (3.20)
Living in Poverty (%), Mean (SD)	18.56 (5.18)	17.62 (5.29)	19.32 (4.96)
High School Education (%), Mean (SD)	84.63 (5.35)	85.91 (5.10)	83.60 (5.33)

NOTES: N may vary slightly across characteristics due to some missing data. 2. Column percentages may not total 100 due to rounding.

Abbreviations: CNM, Certified Nurse Midwife; DO, Doctor of Osteopathy; HIV, human immunodeficiency virus; IQR, interquartile range; NP, Nurse Practitioner; PA, Physician Assistant; PrEP, pre-exposure prophylaxis; MD, Medical Doctor; SD, standard deviation.

[a]Prescribing providers included providers who could prescribe with and without physician supervision at clinics that did not provide PrEP. Eighty-one (51.6%) could prescribe independently and 76 (48.4%) could prescribe with physician supervision.

[b]Nonprescribing providers included providers who could not prescribe medications at clinics that did not provide PrEP.

[c]Providers could select multiple roles.

[d]In clinic catchment area.

Among nonprescribing providers, there was a significant negative association with years worked in a clinic role (−0.038; 95% CI, −.078 to 0.010). Among prescribing providers, there were no significant covariate associations.

Attitudes Towards Pre-Exposure Prophylaxis

The mean attitudes score was 3.52 (SD = 0.55) and higher for prescribing versus nonprescribing providers ($P < .0001$) (Supplemental Table 4). However, scores on the attitudes subcategory of Acceptability of PrEP Integration in FP Settings did not differ by prescriber status. For the attitudes subcategory of Clinical and Socio-behavioral Attitudes towards PrEP, prescribing providers had more favorable attitudes than nonprescribing providers ($P < .0001$). Unadjusted associations between provider-, clinic-, and county-level covariates and PrEP attitudes are shown in Supplemental Table 5. In the overall adjusted model, PrEP attitudes were positively associated with prescribing ability (0.192; 95% CI, .071–0.313) (Figure 2, Supplemental Table 6). Among nonprescribing providers, there were significant positive associations with onsite insurance assistance (0.180; 95% CI, .021–0.340) and county HIV prevalence (0.095; 95% CI, .004–0.186). Among prescribing providers, there was a significant positive association with county percentage of high school education (0.022; 95% CI, .003–0.040).

Self-Efficacy in Pre-Exposure Prophylaxis Care

The overall mean self-efficacy score was 3.4 (SD = 0.78) and was higher for prescribing providers versus nonprescribing providers ($P < .0001$) (Table 2). When self-efficacy survey items were grouped by the steps of PrEP care, scores were higher among prescribing providers regarding each step ($P < .0001$). Comparison of scores between steps indicated prescribing and nonprescribing providers were most confident in PrEP screening, less confident regarding PrEP follow up, and least confident regarding PrEP initiation ($P < .0001$). Unadjusted associations between provider-, clinic-, and county-level covariates and self-efficacy in PrEP care are shown in Supplemental Table 7.

In the overall adjusted model, self-efficacy in PrEP care was positively associated with prescribing ability (0.424; 95% CI, .290–0.559), attitudes towards PrEP (0.213; 95% CI, 0.094–0.332), and contraception self-efficacy (0.439; 95% CI, .367–0.511) and negatively associated with county percentage Hispanic/Latinx in the population (−0.089; 95% CI, −.162 to −0.017) (Figure 3, Supplemental Table 8). Among prescribing providers, there were significant associations with PrEP knowledge (0.064; 95% CI, .007–0.122), contraception self-efficacy (0.459; 95% CI, .328–0.589), county percentage uninsured (0.038; 95% CI, .011–0.065), and county percentage Hispanic/Latinx (−0.136; 95% CI, −.236 to −0.037). Among nonprescribing providers, there were significant associations with attitudes towards PrEP (0.276; 95% CI, .097–0.455) and contraception self-efficacy (0.435; 95% CI, .346–0.524).

DISCUSSION

We describe Title X provider knowledge, attitudes, and self-efficacy in PrEP care in the Southern United States and associations with provider-, clinic-, and county-level characteristics. Our findings reveal gaps in FP provider knowledge, attitudes, and confidence in certain steps of PrEP care, suggesting potential avenues to tailor provider training or develop models of PrEP care to bridge these gaps.

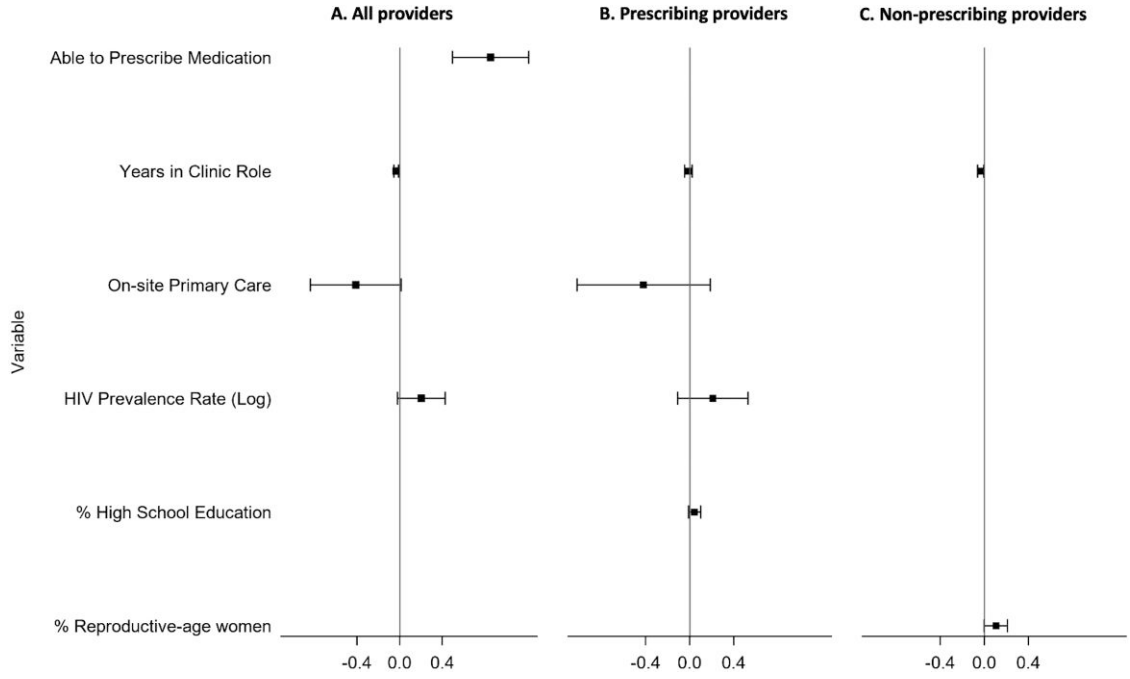

Figure 1. Linear mixed models results for knowledge about pre-exposure prophylaxis among (A) all providers, (B) prescribing providers, and (C) nonprescribing providers. Variables were selected for inclusion in the reduced model using a backward selection approach. Variables missing in the model results were not selected. The percentage and prevalence variables are the percentages/numbers (log transformed where appropriate) among the county population where the provider's clinic is located and based on data from the US Census Bureau 2010 Census and AIDSVu. The points indicate linear mixed model estimates and whiskers indicate 95% confidence intervals. HIV, human immunodeficiency virus.

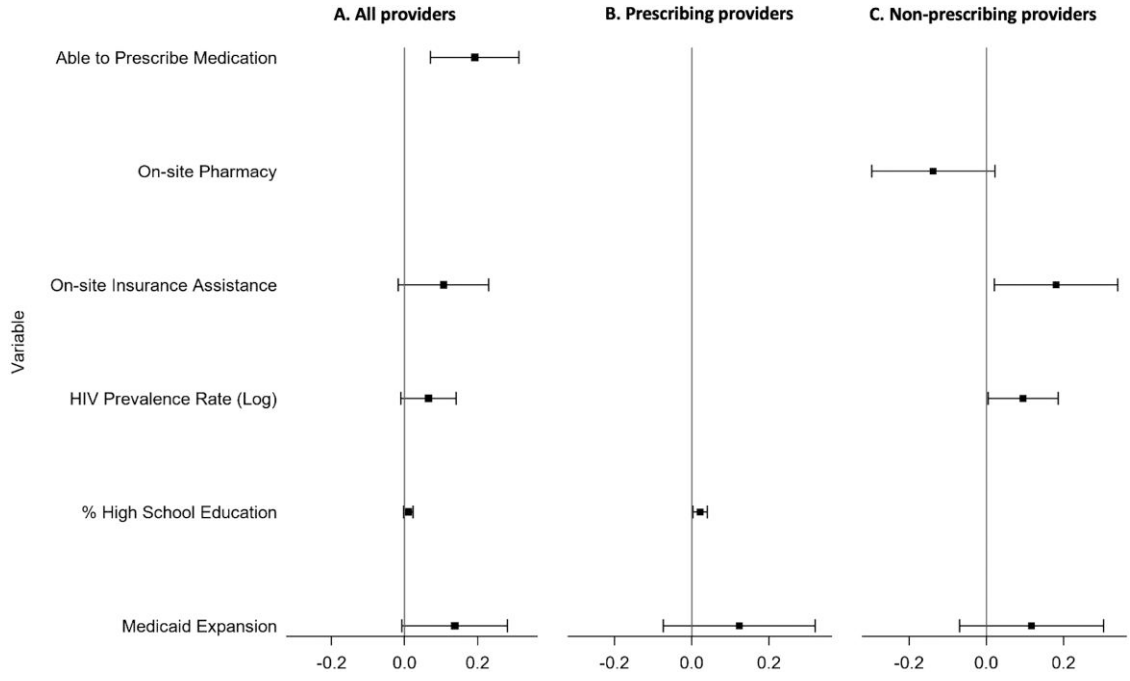

Figure 2. Linear mixed models results for attitudes towards pre-exposure prophylaxis among (A) all providers, (B) prescribing providers, and (C) nonprescribing providers. Variables were selected for inclusion in the reduced model using a backward selection approach. Variables missing in the model results were not selected. The percentage and prevalence variables are the percentages/numbers (log transformed where appropriate) among the county population where the provider's clinic is located and based on data from the US Census Bureau 2010 Census and AIDSVu. The points indicate linear mixed model estimates and whiskers indicate 95% confidence intervals. HIV, human immunodeficiency virus.

Table 2. Differences in Self-Efficacy in PrEP Care Between Prescribing and Nonprescribing Providers

Provider Self-Efficacy Survey Topics and Questions[a]	All Providers N = 325 (Mean, SD)	Prescribing Providers[b] N = 149 (Mean, SD)	Nonprescribing Providers[c] N = 176 (Mean, SD)	*P* Value[d]
PrEP Screening	3.57 (.81)	3.94 (.64)	3.25 (.81)	<.0001
A. Patient Engagement	3.67 (0.84)	4.02 (0.66)	3.38 (0.86)	<.0001
HIV risk assessment per CDC PrEP guidelines				
PrEP readiness assessment				
PrEP side-effects counseling				
PrEP adherence counseling				
Patient referral to subspecialists for PrEP/HIV				
B. Initial Clinical Evaluation	3.46 (0.91)	3.86 (0.75)	3.12 (0.90)	<.0001
Test for HIV				
Screen for acute HIV				
Kidney function assessment				
Test for and interpret active hepatitis B virus results				
PrEP medication interactions assessment				
PrEP Initiation	2.33 (0.95)	2.70 (1.02)	2.01 (0.76)	<.0001
PrEP prescription	2.34 (1.26)	3.07 (1.31)	1.73 (0.82)	
PrEP insurance navigation	2.31 (1.03)	2.32 (1.05)	2.30 (1.01)	
PrEP Follow-up	3.29 (1.15)	3.55 (1.13)	3.07 (1.12)	<.0001
Medication adherence counseling and side-effect assessment				
Appropriate interval laboratory testing				
Overall PrEP self-efficacy	3.35 (0.78)	3.71 (0.66)	3.05 (0.75)	<.0001
Contraception self-efficacy	4.03 (0.92)	4.28 (0.70)	3.82 (1.03)	<.0001
Pregnancy intentions and contraceptive counseling initial assessment				
Pregnancy intentions and contraceptive counseling follow-up				

NOTES: Self-efficacy scores for each step of PrEP care represent the means of scores corresponding to questions within each step. Overall PrEP self-efficacy represents the mean of all steps of PrEP care.

Abbreviations: CDC, Centers for Disease Control and Prevention; HIV, human immunodeficiency virus; IQR, interquartile range; PrEP, pre-exposure prophylaxis; SD, standard deviation.

[a]Survey question text is abridged in this table to highlight question topic.

[b]Prescribing providers included providers who could prescribe with and without physician supervision at clinics that did not provide PrEP.

[c]Nonprescribing providers included providers who could not prescribe medications at clinics that did not provide PrEP.

[d]*P* values comparing prescribing and nonprescribing provider self-efficacy scores were calculated using unpaired *t* tests. *P* values described in the manuscript text comparing self-efficacy scores between the steps of the PrEP care were calculated using paired *t* tests.

In our analysis, PrEP knowledge scores were higher among prescribing providers (those with the ability to prescribe medication), as expected due to differences in training and experience. In addition, PrEP knowledge was negatively associated with years worked in a clinic role, indicating that providers further out from clinical training may benefit from continuing medical education about PrEP. Among prescribing providers, there were no additional covariates associated with PrEP knowledge, suggesting that tailoring the clinical content in PrEP trainings by ability to prescribe medication may be a useful approach.

Although overall attitudes toward PrEP were more favorable among prescribing providers, there was more nuance when PrEP attitudes were subcategorized. Although both prescribing and nonprescribing providers had favorable attitudes regarding integration of PrEP in FP settings, nonprescribing providers had significantly less favorable attitudes regarding the clinical and sociobehavioral aspects of PrEP, including concerns about PrEP efficacy, drug resistance, and risk compensation. These findings suggest that PrEP training for nonprescribing providers should provide content directed to overcome unfavorable perceptions of PrEP, particularly because more favorable attitudes regarding an intervention can strengthen self-efficacy [32].

Although, as expected, prescribing providers had higher self-efficacy scores compared to nonprescribing providers, both groups were least confident in PrEP initiation compared to the other steps of PrEP care. This finding aligns with previous literature describing low PrEP prescription rates despite a high-level of provider awareness and support for PrEP in the United States [8, 33, 34]. Furthermore, other studies have suggested that decreased knowledge about insurance navigation (a component of the PrEP initiation step) stymies providers' ability to prescribe PrEP [33, 35]. Lack of onsite primary care services and lack of Medicaid expansion may exacerbate insurance navigation challenges and contribute to lower provider confidence in PrEP initiation [33, 35, 36].

Our findings inform how provider training can be optimized and tailored to improve provider knowledge, attitudes, and self-efficacy in PrEP care [8, 33]. Customized provider training has

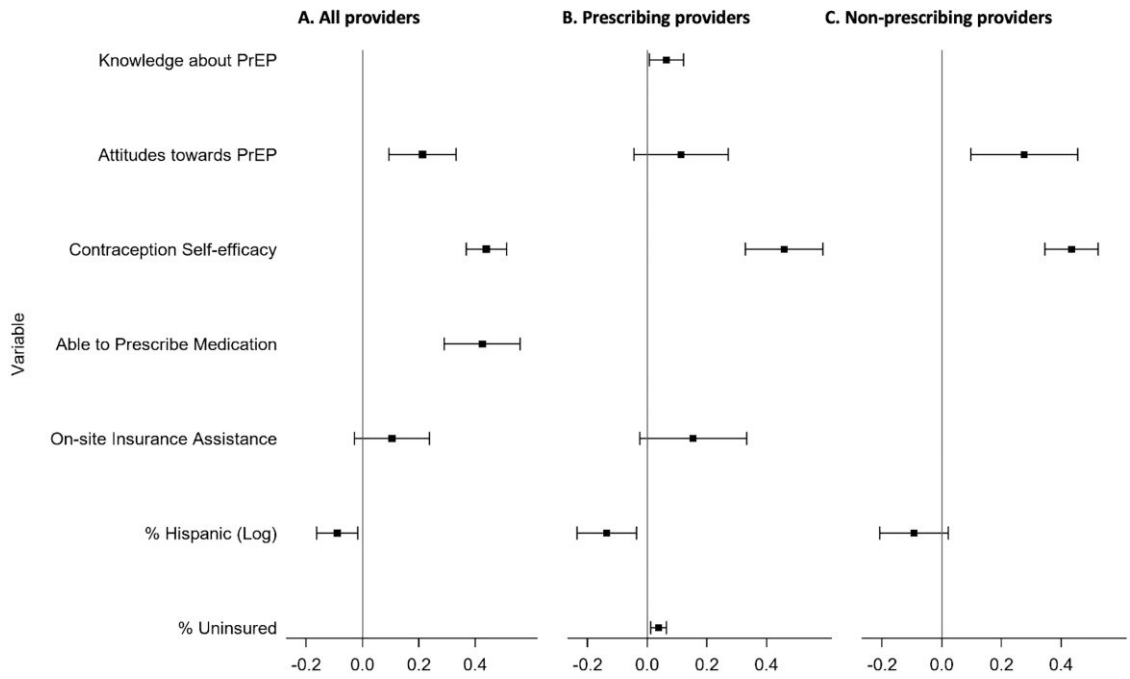

Figure 3. Linear mixed models results for self-efficacy in pre-exposure prophylaxis (PrEP) care among (A) all providers, (B) prescribing providers, and (C) nonprescribing providers. Variables were selected for inclusion in the reduced model using a backward selection approach. Variables missing in the model results were not selected. The percentage and prevalence variables are the percentages/numbers (log transformed where appropriate) among the county population where the provider's clinic is located and based on data from the US Census Bureau 2010 Census and AIDSVu. The points indicate linear mixed model estimates and whiskers indicate 95% confidence intervals.

been associated with effective implementation of other healthcare interventions, such as improving negative attitudes towards buprenorphine prescription for opioid use disorder [32] and facilitating effective implementation of evidence-based tobacco use treatment in health centers [37]. Emerging PrEP literature also supports customized training; recent studies indicated the need for (1) tailoring training to provider needs [38] and (2) provider preferences regarding PrEP training content and format depending on clinical experience [8, 33]. Other studies have shown clinician mentoring programs to be successful training models to bolster the HIV workforce [39, 40]. Although various PrEP training formats exist, our findings support utilizing provider-, clinic-, and county-level characteristics and CFIR-guided assessments to shape trainings for specific audiences [33, 41]. Finally, customization through a "train-the-trainer" model could be applied to improve PrEP training. This model has succeeded in disseminating HPV vaccine education with subsequent increased delivery and uptake of the vaccine [42]. Our findings support use of this model because it has the potential to reach prescribing and nonprescribing providers. Training both clinicians and staff has been noted to improve PrEP initiation and delivery [35].

Results from our study demonstrate 3 potential paths to optimize provider PrEP training. The first path is that of "tailored provider training" through approaches such as addressing unfavorable provider attitudes toward PrEP, integrating PrEP and FP training, and focusing education on the PrEP initiation steps. Increased self-efficacy was associated with increased knowledge and favorable attitudes regarding PrEP in our analysis; trainings that address all 3 components may therefore improve provider confidence in PrEP care. In addition, because contraception and PrEP self-efficacy were associated, future trainings integrating clinical content about PrEP and contraception should be considered and may be beneficial in the context of long-acting PrEP and multipurpose prevention methods.

The second path for optimizing provider PrEP training is to "target PrEP education in clinics with less support". Onsite insurance assistance and Medicaid expansion were associated with more favorable PrEP attitudes, although findings were not statistically significant in all models. Targeting clinics in areas without Medicaid expansion and with less pre-existing support for training clinic staff in PrEP insurance navigation and access programs may be beneficial.

Our results also inform a third path of developing "novel models of care" that can expand PrEP delivery. Given that providers were least confident in PrEP initiation, alternative PrEP delivery strategies, such as using telehealth or referral models for PrEP initiation with existing PrEP providers, may allow providers in clinical settings that are new to PrEP to transition more readily from "PrEP awareness" to "willingness to prescribe PrEP", while maintaining longitudinal care of their patients. Such models of care may be used as a "bridge program" for clinics until providers gain the necessary resources and comfort to conduct PrEP initiation.

We acknowledge several limitations. First, this study was based on a convenience sample of providers, thus introducing potential selection bias. Responses to questions addressing attitudes and self-efficacy may also be subject to social desirability bias. Second, although collinear covariates were excluded from our models, because the number of measured covariates was finite, there is potential for unmeasured confounders. For example, the county-level covariate measuring percentage Hispanic/Latinx was a significant covariate in certain models; this finding may result from an unmeasured confounder. Third, this analysis focused on the provider-level outcomes within the CFIR domain, Characteristics of Individuals, and was conducted only in non-PrEP clinics. Previous work from our group and others have shown numerous CFIR constructs relevant to PrEP implementation [14, 43], including inner and outer setting factors that were not assessed in this analysis. Additional work is needed to examine provider-level and other successful pathways for PrEP implementation, including within clinics that already provide PrEP.

Systemic racism has contributed to disparities in sexual and reproductive health outcomes in the United States [44], including disparities in HIV prevention and care. Strategies to eliminate disparities are urgently needed. Specific to PrEP, key strategies that have been proposed to address racism and other structural determinants include the following: improving patient-provider communication, supporting a diverse healthcare workforce, and understanding how to best address structural determinants as part of PrEP care [45]. Although the majority of patients accessing Title X FP services in the South identify as Black or Hispanic/Latinx [46], most providers surveyed identified as non-Hispanic White. These findings reinforce the importance of bolstering a more diverse healthcare workforce and addressing racism and structural determinants as an integral component of provider PrEP training [45, 47]. Finally, although this analysis focused on provider perspectives, integrating patients' voices must also be central to implementation efforts and research [45, 47, 48].

Guidelines and policies affecting PrEP and reproductive healthcare in the United States have shifted since completion of this survey in 2018. Updated Centers for Disease Control and Prevention's PrEP clinical practice guideline's recommendation of universal PrEP education is a key step in improving PrEP access for women [49]. In addition, the recent approval of injectable cabotegravir for HIV prevention has provided an additional option for women [49, 50]. However, the recent US Supreme Court's decision removing the federal right to abortion has resulted in abortion restrictions and bans in many states, likely reducing availability of HIV and sexual health services [51]. Sexual and reproductive health clinics, providers, and patients face severely restricted policies in 10 of the 18 states surveyed in this study, thus presenting a bleak future for safety-net women's healthcare and HIV prevention, particularly in the South [52].

CONCLUSIONS

In conclusion, optimizing provider knowledge, attitudes, and self-efficacy in PrEP is an important step to successful PrEP implementation in FP settings and in other clinical contexts in high HIV burden areas. Our results indicate that training focused on PrEP initiation for all providers in the clinical care team and alternative models of care to support PrEP initiation may be key strategies to transition providers from PrEP awareness to prescription. Our analysis also suggests that addressing provider lack of knowledge and concerns about PrEP may improve confidence in PrEP care. In addition to tackling system-level challenges, future implementation studies should focus on tailoring provider training and models of care to strengthen the ability of clinics to prescribe PrEP to improve PrEP delivery and uptake for women in the South.

Supplementary Data

Supplementary materials are available at *Open Forum Infectious Diseases* online. Consisting of data provided by the authors to benefit the reader, the posted materials are not copyedited and are the sole responsibility of the authors, so questions or comments should be addressed to the corresponding author.

Acknowledgments

Disclaimer. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

Financial support. This research was funded by the National Institutes of Health Grant U24HD089880. A. R.'s effort was funded by the National Center for Advancing Translational Sciences of the National Institutes of Health under Award Numbers UL1TR002378 and TL1TR002382.

Potential conflicts of interest: All authors: No reported conflicts of interest. All authors have submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest.

References

1. Centers for Disease Control and Prevention. Issue Brief: HIV in the Southern United States. 2019. Available at: https://www.cdc.gov/hiv/pdf/policies/cdc-hiv-in-the-south-issue-brief.pdf. Accessed January 31, 2022 .
2. Centers for Disease Control and Prevention. HIV and Women. Available at: https://www.cdc.gov/hiv/pdf/group/gender/women/cdc-hiv-women.pdf. Accessed January 31, 2022.
3. Fonner VA, Dalglish SL, Kennedy CE, et al. Effectiveness and safety of oral HIV preexposure prophylaxis for all populations. AIDS **2016**; 30:1973–83.
4. Fauci AS, Redfield RR, Sigounas G, Weahkee MD, Giroir BP. Ending the HIV epidemic: a plan for the United States. JAMA **2019**; 321:844–5.
5. Siegler AJ, Mouhanna F, Giler RM, et al. The prevalence of pre-exposure prophylaxis use and the pre-exposure prophylaxis–to-need ratio in the fourth quarter of 2017, United States. Ann Epidemiol **2018**; 28:841–9.
6. Huang WZ YA, Smith DK, Harris N, Hoover KW. HIV Preexposure prophylaxis, by race and ethnicity - United States, 2014–2016. MMWR Morb Mortal Wkly Rep **2018**; 67:1147–50.
7. Centers for Disease Control and Prevention. Monitoring selected national HIV prevention and care objectives by using HIV surveillance data—United States and 6 dependent areas, 2019. HIV Surveillance Supplemental Report 2021; 26(No.2). Available at: http://www.cdc.gov/hiv/library/reports/hiv-surveillance.html. Accessed May 15, 2022.
8. Zhang C, McMahon J, Fiscella K, et al. HIV pre-exposure prophylaxis implementation cascade among health care professionals in the United States: implications from a systematic review and meta-analysis. AIDS Patient Care STDS **2019**; 33: 507–27.
9. AVAC. Ongoing and Planned PrEP Demonstration and Implementation Studies. Available at: https://www.avac.org/resource/ongoing-and-planned-prep-demonstration-and-implementation-studies. Accessed January 19, 2020.

10. Patel AS, Goparaju L, Sales JM, et al. Brief report: PrEP eligibility among at-risk women in the southern United States: associated factors, awareness, and acceptability. J Acquir Immune Defic Syndr **2019**; 80:527–32.
11. Sales JM, Cwiak C, Haddad LB, et al. Brief report: impact of PrEP training for family planning providers on HIV prevention counseling and patient interest in PrEP in Atlanta, Georgia. J Acquir Immune Defic Syndr **2019**; 81:414–8.
12. Auerbach JD, Kinsky S, Brown G, Charles V. Knowledge, attitudes, and likelihood of pre-exposure prophylaxis (PrEP) use among US women at risk of acquiring HIV. AIDS Patient Care STDS **2015**; 29:102–10.
13. Sales JM, Sheth AN. Associations among perceived HIV risk, behavioral risk and interest in PrEP among black women in the southern US. AIDS Behav **2019**; 23: 1871–6.
14. Sales JM, Escoffery C, Hussen SA, et al. Pre-exposure prophylaxis implementation in family planning services across the southern United States: findings from a survey among staff, providers and administrators working in title X-funded clinics. AIDS Behav **2021**; 25:1901–12.
15. Mayer KH, Chan PA RRP, Flash CA, Krakower DS. Evolving models and ongoing challenges for HIV preexposure prophylaxis implementation in the United States. J Acquir Immune Defic Syndr **2018**; 77:119–27.
16. Petroll AE, Walsh JL, Owczarzak JL, McAuliffe TL, Bogart LM, Kelly JA. PrEP awareness, familiarity, comfort, and prescribing experience among US primary care providers and HIV specialists. AIDS Behav **2017**; 21:1256–67.
17. Seidman D, Carlson K, Weber S, Witt J, Kelly PJ. United States Family planning providers' knowledge of and attitudes towards preexposure prophylaxis for HIV prevention: a national survey. Contraception **2016**; 93:463–9.
18. Blumenthal J, Jain S, Krakower D, et al. Knowledge is power! increased provider knowledge scores regarding Pre-exposure prophylaxis (PrEP) are associated with higher rates of PrEP prescription and future intent to prescribe PrEP. AIDS Behav **2015**; 19:802–10.
19. Smith DK, Toledo L, Smith DJ, Adams MA, Rothenberg R. Attitudes and program preferences of African-American urban young adults about pre-exposure prophylaxis (PrEP). AIDS Educ Prev **2012**; 24:408–21.
20. Jones JT, deCastro BR, August EM, Smith DK. Pre-exposure prophylaxis (PrEP) awareness and prescribing behaviors among primary care providers: docStyles survey, 2016–2020, United States. AIDS Behav **2021**; 25:1267–75.
21. Damschroder LJ, Aron DC, Keith RE, Kirsh SR, Alexander JA, Lowery JC. Fostering implementation of health services research findings into practice: a consolidated framework for advancing implementation science. Implement Sci **2009**; 4:50.
22. Piper KN, Escoffery C, Sales JM, Sheth AN. Models of HIV Pre-exposure prophylaxis care used in title X family planning clinics in the southern U.S. J Adolesc Health **2021**; 68:480–7.
23. Sales JM, Escoffery C, Hussen SA, et al. Pre-exposure prophylaxis integration into family planning services at title X clinics in the southeastern United States: a geographically-targeted mixed methods study (phase 1 ATN 155). JMIR Res Protoc **2019**; 8:e12774.
24. Norton WE. An exploratory study to examine intentions to adopt an evidence-based HIV linkage-to-care intervention among state health department AIDS directors in the United States. Implement Sci **2012**; 7:27.
25. Ehrhart MG, Aarons GA, Farahnak LR. Assessing the organizational context for EBP implementation: the development and validity testing of the implementation climate scale (ICS). Implement Sci **2014**; 9:157.
26. Helfrich CD, Li Y-F, Sharp ND, Sales AE. Organizational readiness to change assessment (ORCA): development of an instrument based on the promoting action on research in health services (PARIHS) framework. Implement Sci **2009**; 4:38.
27. Gavin L, Pazol K. Providing quality family planning services—recommendations from CDC and the U.S. Office of population affairs. MMWR Morb Mortal Wkly Rep **2016**; 65:231–4.
28. Centers for Disease Control and Prevention. HIV Pre-exposure Prophylaxis (PrEP) Care System. Available at: https://www.cdc.gov/hiv/effective-interventions/prevent/prep/index.html. Accessed February 15, 2021.
29. Profile of General Population and Housing Characteristics: 2010. 2010 Demographic Profile Data. U.S. Census Bureau, 2010 Census. Available at: https://www.census.gov/programs-surveys/decennial-census/data/datasets.2010.List_327707051.html#list-tab-List_327707051. Accessed November 13, 2018.
30. AIDSVu. 2015 HIV Prevalence Data. Emory University, Rollins School of Public Health. Atlanta, GA. Available at: www.aidsvu.org. Accessed November 18, 2018.
31. Ingram DD, Franco SJ. 2013 NCHS urban-rural classification scheme for counties. National Center for Health Statistics. Vital Health Stat. **2014**; 2(166):1–73.
32. Louie DL, Assefa MT, McGovern MP. Attitudes of primary care physicians toward prescribing buprenorphine: a narrative review. BMC Fam Pract **2019**; 20: 157.
33. Rao S, Reed AE, Parchem B, et al. Optimizing provider preexposure prophylaxis (PrEP) training: a cross-sectional analysis of recommendations from providers across the PrEP implementation cascade. AIDS Behav **2022**; 26(1):218–31.
34. Krakower D, Ware N, Mitty JA, Maloney K, Mayer KH. HIV providers' perceived barriers and facilitators to implementing pre-exposure prophylaxis in care settings: a qualitative study. AIDS Behav **2014**; 18:1712–21.
35. Calabrese SK, Magnus M, Mayer KH, et al. Putting PrEP into practice: lessons learned from early-adopting U.S. providers' firsthand experiences providing HIV pre-exposure prophylaxis and associated care. PLoS One **2016**; 11:e0157324.
36. Karletsos D, Stoecker C. Impact of Medicaid expansion on PrEP utilization in the US: 2012–2018. AIDS Behav **2021**; 25:1103–11.
37. VanDevanter N, Vu M, Nguyen A, et al. A qualitative assessment of factors influencing implementation and sustainability of evidence-based tobacco use treatment in Vietnam health centers. Implement Sci **2020**; 15:73.
38. Pratt MC, Hill SV, Elopre L, Simpson T, Lanzi R, Matthews LT. PrEP prescription for black adolescent girls and young women in Alabama: findings from a survey of healthcare providers. J Int Assoc Provid AIDS Care **2022**; 21.
39. Boehler M, Schechtman B, Rivero R, et al. Developing the HIV workforce: the MATEC clinician scholars program. J Assoc Nurses AIDS Care **2016**; 27:246–60.
40. Wagner CMJ, Carlberg-Racich S, Linsk NL, et al. Impacts of longitudinal mentorship to strengthen the HIV workforce: qualitative evidence of changes in clinicians' knowledge, attitudes, and practice. J Assoc Nurses AIDS Care **2017**; 28: 938–52.
41. Clement ME, Seidelman J, Wu J, et al. An educational initiative in response to identified PrEP prescribing needs among PCPs in the southern U.S. AIDS Care **2018**; 30:650–5.
42. Brewer NT, Mitchell CG, Alton Dailey S, et al. HPV vaccine communication training in healthcare systems: evaluating a train-the-trainer model. Vaccine **2021**; 39:3731–6.
43. Li DH, Benbow N, Keiser B, et al. Determinants of implementation for HIV pre-exposure prophylaxis based on an updated consolidated framework for implementation research: a systematic review. J Acquir Immune Defic Syndr **2022**; 90:S235–46.
44. Prather C, Fuller TR, Jeffries WL, et al. Racism, African American women, and their sexual and reproductive health: a review of historical and contemporary evidence and implications for health equity. Health Equity **2018**; 2:249–59.
45. Seidman D, Logan R, Weber S, Gandhi A, Blackstock O. Reimagining preexposure prophylaxis provision for women in the United States. Clin Infect Dis **2022**; 74:2243–8.
46. Fowler CI, Gable J, Lasater B. Family Planning Annual Report: 2020 National Summary. Washington, DC: *Office of Population Affairs, Office of the Assistant Secretary for Health, Department of Health and Human Services*. 2021. Available at: https://opa.hhs.gov/research-evaluation/title-x-services-research/family-planningannual-report. Accessed September 19, 2022.
47. Chandler R, Guillaume D, Wells J, Hernandez N. Let me prep you to PREP me: amplifying the voices of black women and their providers to consider PrEP as an HIV prevention option. Int J Environ Res Public Health **2022**; 19:1414–26.
48. Irie WC, Calabrese SK, Patel RR, Mayer KH, Geng EH, Marcus JL. Preferences for HIV preexposure prophylaxis products among black women in the U.S. AIDS Behav **2022**; 26:2212–23.
49. Centers for Disease Control and Prevention. US Public Health Service: Preexposure prophylaxis for the prevention of HIV infection in the United States—2021 Update: a clinical practice guideline. 2021. Available at: https://www.cdc.gov/hiv/pdf/risk/prep/cdc-hiv-prep-guidelines-2021.pdf. Accessed September 20, 2022.
50. US Food and Drug Administration. FDA Approves First Injectable Treatment for HIV Pre-Exposure Prevention. December 20, 2021. Available at: https://www.fda.gov/news-events/press-announcements/fda-approves-first-injectable-treatment-hiv-pre-exposure-prevention. Accessed February 1, 2022.
51. Infectious Diseases Society of America & HIV Medicine Association. Reducing Access to Safe and Legal Abortion: Infectious Diseases and Health Equity Impacts. August 5, 2022. Available at: https://www.hivma.org/globalassets/google-ad/reducing-access-to-safe-and-legal-abortion-id-impacts-.pdf. Accessed September 15, 2022.
52. The New York Times. Tracking the States Where Abortion Is Now Banned. The New York Times. Available at: https://www.nytimes.com/interactive/2022/us/abortion-laws-roe-v-wade.html. Accessed September 22, 2022.