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Primary Care Providers' Knowledge, Attitudes and Beliefs about HIV Pre-exposure Prophylaxis (PrEP): Informing Network-based Interventions

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Abstract

Increasing access to pre-exposure prophylaxis (PrEP) in primary care settings for patients who may be at risk for HIV could help increase PrEP uptake, which has remained low among certain key risk populations. Previous work suggests a high degree of variability among primary care providers regarding attitudes, knowledge, and prescriptive practices related to PrEP. The current study sought to better understand factors contributing to variation in PrEP prescribing and assess potential interventions. Primary care providers identified from national claims data as having either high- or low-likelihood of having PrEP-eligible patients based on their prescribing practices for other sexually transmitted infections were interviewed by telephone. The study yielded important information about primary care providers' knowledge, attitudes, and beliefs about PrEP, as well as barriers and facilitators to prescribing PrEP. Key recommendations that can inform provider-focused, network-based interventions to increase PrEP-prescribing include increasing patient education to increase demand from providers, and enhancing provider education and connections with other local providers. Other recommendations include leveraging technology (e.g., dashboards illustrating prescription rates as compared to peers), providing prescribing cheat sheets, and instituting standardized sexual health screenings.

Keywords

HIV; Pre-exposure Prophylaxis; Primary Care; Implementation; Network Intervention

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Introduction

Antiretroviral drug combinations such as emtricitabine and tenofovir (disoproxil fumarate or alafenamide) taken as preexposure prophylaxis (PrEP) are highly effective in preventing HIV infection (Anderson et al., 2012; Liu et al., 2015; McCormack & Dunn, 2015; Molina et al., 2015). In 2014, the Centers for Disease Control and Prevention (CDC) endorsed PrEP as a critical element for HIV prevention and released guidelines for its use in adults at risk for HIV infection (Centers for Disease Control and Prevention, 2014). Today, PrEP is widely accepted as a prevention strategy for individuals at risk for HIV (Koblin et al., 2011; Liu et al., 2013; Mimiaga, Closson, et al., 2014), however, there are currently not enough trained HIV specialists to meet the growing need (Silapaswan et al., 2017). Only 5% of people at risk for HIV who would benefit from PrEP currently take it (Smith et al., 2018), with disparities in key risk populations. For example, among men who have sex with men (MSM) for whom PrEP is likely to be indicated, only 42% of white MSM, 30% of Hispanic/Latinx MSM, and 26% of Black MSM reported past-year PrEP use (Kanny et al., 2019). Health promotion and HIV prevention efforts are now shifting focus to targeting PrEP uptake among those at highest-risk, such as MSM of color, and because PrEP is a preventative intervention for otherwise healthy individuals, primary care providers (PCPs) may be among those best suited to reach them.

Although guidelines that promote the provision of PrEP in primary care have been developed and made widely available (Centers for Disease Control and Prevention, 2014), only a minority (28 – 45%) of PCPs, which includes physicians, nurse practitioners, and physician assistants, indicate a willingness to prescribe PrEP (Jones et al., 2021; Petroll et al., 2017b; Walsh & Petroll, 2017) and currently only about 13 – 19% of PCPs have actually prescribed this medication to patients at risk for HIV (Jones et al., 2021; Petroll et al., 2017a). There is evidence suggesting that there is some disagreement among PCPs as to how best to identify and competently engage patients in informative conversations about PrEP (Arnold et al., 2012; Karris et al., 2014; Mimiaga, White, et al., 2014; Puro et al., 2013). The ‘purview paradox’ has been highlighted as another a key obstacle (Krakower et al., 2014), which refers to contrary beliefs about optimal clinic setting (i.e., primary or HIV specialty care), for delivering PrEP to at-risk patients. The paradox is that neither HIV physicians nor PCPs consider the provision of PrEP services to fall within their clinical domain. The majority of PCPs report that they do not regularly screen for sexual-risk behaviors among their patients, citing reasons like “I only screen patients known to be in high-risk groups” or “I wait for the patient to raise concerns”, and believe that because PrEP consists of providing HIV antiretroviral medications, it is best provided by HIV care providers. On the other hand, because PrEP is a preventative intervention for folks who are HIV-negative, many HIV providers believe PrEP interventions will have wider reach and are best provided in primary care (Montaño et al., 2008; Nurutdinova et al., 2011).

Prior work has identified barriers to PrEP arising at three socioecological levels: healthcare system, provider, and individual (Pinto et al., 2018). Healthcare system-level barriers may include lack of communication about, funding for, and access to PrEP. Provider-level barriers include lack of knowledge, negative attitudes toward PrEP, lack of training in PrEP provision, disagreements about who might be appropriate candidates for PrEP use,

and concerns about insurance coverage for PrEP (Pinto et al., 2018). The solutions that have been proposed to address knowledge gaps include trainings and interventions to assist providers in identifying appropriate PrEP candidates. The intersection at the individual level between PrEP-stigma, HIV-stigma, transphobia, homophobia, and disparities across gender, racial, and ethnic groups also has been identified as a significant barrier to providing PrEP in primary care settings but few interventions currently address these barriers (Pinto et al., 2018). Moreover, rural settings have been shown to present additional barriers to providing PrEP (Hoth et al., 2019; Owens et al., 2020). Prior work also has found that providers' prejudicial beliefs (e.g., assessments of the likelihood of risk behavior based on race), (Calabrese et al., 2014) concerns about the efficacy or "real world" effectiveness of PrEP, toxicities, future resistance, and about patients' behavior (e.g., sexual risk and lack of adherence) often were reported as substantial barriers to PrEP prescribing (Pinto et al., 2018).

Because there are multiple reasons for low PrEP prescribing rates among PCPs, efforts to increase rates require a diverse set of provider-focused interventions. For example, if low prescription rates are driven by perceptions about sexual risks or lack of awareness of current research on the topic, then this would suggest educational outreach to targeted members of the physician community could be highly effective at increasing appropriate PrEP prescribing. In contrast, if social stigma affects PrEP prescription rates then the best policy may be concentrating primary care for MSM among a select set of physicians already supportive of the treatment, because changing an entire region's culture of MSM stigma, or asking physicians to be out of step with it, would necessitate more intensive, difficult, and expensive interventions than clustering MSM care among providers who already support and serve MSM. The diversity of factors impacting prescribing behavior within the physician community makes broad-based education campaigns costly and inefficient. However, given the scientific evidence to support PrEP, uptake by PCPs, who are unlikely to learn of the treatment from traditional avenues, may be improved by targeted interventions that take advantage of social influence and social learning processes, particularly if those interventions involve contact from infectious disease physicians with whom they already share patients. To date, however, there has been no empirical research supporting the development of network-based interventions specifically designed for increasing prescribing behavior for PrEP.

The diffusion of innovation and the uptake of novel best practices in HIV prevention are often network-based processes because they generally rely on transmission of information between people or organizations (Cain & Mittman, 2002; Rogers, 2010). Social network analysis (SNA) provides an important tool for identifying and understanding the social and contextual factors relevant to uptake of new behaviors such as prescribing PrEP (Valente, 2005) The study of diffusion of innovation through networks has been a key focus of SNA since its inception (Coleman et al., 1966). Consistent with research on diffusion and social networks in the adoption of new practices, (Rogers, 1976, 2010; Valente, 1996), we view physician networks as having the potential to influence uptake of best practices through multiple mechanisms, the primary ones being by: (a) shaping the exposure of providers to innovations in HIV prevention; (b) influencing the availability of information about

successful PrEP programming; and (c) affecting providers' willingness to change through peer influence, social norms, and monitoring mechanisms.

The primary purpose of the current study was to obtain information and recommendations through semi-structured qualitative interviews to inform the development of social network-based provider interventions that would address barriers at multiple levels and increase overall PrEP prescribing among PCPs. Because of the myriad barriers to prescribing PrEP that providers face, the goal of these interviews was to delineate which network-based interventions would most effectively address these barriers and to better gauge the acceptability of several possible interventions. We collected information about PCP knowledge, attitudes, and beliefs about PrEP; current PrEP prescribing practices and models; perceived barriers and facilitators to prescribing; types of interventions that would be considered acceptable; and which providers would be most influential in changing prescribing practices among PCPs. Input was sought from PCPs most and least likely to prescribe PrEP to best inform the intervention, with those most likely to prescribe being potential intervention leaders or influencers and those least likely to prescribe as potential intervention targets.

Methods

Between August 2019 and January 2020, we conducted semi-structured telephone interviews with 16 PCPs identified from national claims data as having a high-likelihood of having PrEP-eligible patients because of their prescribing practices for sexually transmitted infections. PCPs were categorized as being high- or low-prescribing based on PrEP prescribing rates between 2016 and 2017. They were determined to have a high -or low-probability of prescribing by means of a logistic regression model for PrEP prescribing (yes/no) among a nationally sampled set of 181,435 primary care physicians who saw sexually active patients between 2016 and 2017. Predictor variables that were significantly and positively associated ($p < 0.01$) with PrEP prescribing during this time period included having a larger number of patients with genital herpes and HIV, and, in counties in which PCPs practice, lower county-level proportion of persons who inject drugs and lower county-level disapproval of gay marriage and homosexual intercourse. Control variables that further informed model predictions but were not statistically significant under conventional standards included each physician's number of connections to other physicians generally and to infectious disease specialists specifically, an indicator of how urban or rural their county was, the number of insurance plans in the county, and the number of insurance plans for which PrEP had preferred coverage status. Full model specifications and results are in Matthews et al. (in review).

With the combination of each physician's actual PrEP prescribing behavior and their expected probability of prescribing from the model, we sought to capture perspectives of positive and negative deviants (i.e., those not expected to prescribe but prescribing anyway, and those expected to prescribe but not prescribing, respectively). Thus, we interviewed PCPs who were categorized into one of two groups: low probability/high prescribing or high probability/low prescribing.

Participants

Potential respondents were identified through claims data if they if they were PCPs thought to have a high likelihood of treating PrEP-eligible, sexually active patients, indicated by a prescription for medications to treat herpes or hepatitis in calendar years 2016 through 2017. The probability of prescribing PrEP was estimated through a logistic regression model that accounted for the number of shared patients with other providers, volume of patients provided medication to treat herpes or hepatitis, and factors potentially related to social stigma including the size of the MSM population in a region, the estimated number of people who inject drugs in a region, and regional measures of attitudes toward homosexuality taken from research conducted by the Pew Research Center (Flores, 2014). The items we chose to use focused on opinions about same-sex marriage and about protection of civil rights. Providers were then ranked from highest to lowest, based on their probability of prescribing PrEP; we attempted to solicit interviews from among the 1000 highest and 1000 lowest ranked providers. We included only individuals who had written at least 2 prescriptions for PrEP in the claims data in order to select a sample we thought likely to be prescribers who were aware of PrEP. We then compared providers' probability of prescribing against actual prescribing behaviors and focused on two key contrasts (low predicted prescribing/high observed prescribing and high predicted prescribing/low observed prescribing). Using this systematic approach, we created two ordered lists, and contacted providers in order according to their place on each list.

Using information from 2016–2017 pharmacy claims from all payer sources, including private insurers, Medicaid, and Medicare, we obtained contact information for providers from the National Provider Identifier (NPI) lookup registry. Research staff called the providers' phone number provided in the NPI data base (most commonly the number was for an office or practice) to schedule telephone interviews and then faxed (or occasionally emailed) information about the study with a return call number and email address. Research staff made contact (by telephone, fax, or email) with 59 PCPs who had low probability of prescribing based on the model but were actually high-prescribers in practice and conducted 11 interviews. They contacted 202 PCPs who had high probability of prescribing based on the model but were actually low-prescribers in practice and conducted 5 interviews.

Interview Procedures

We conducted semi-structured interviews using a secure telephone conference line. We read a consent statement prior to the interview and proceeded if providers consented and agreed to be recorded. We followed a semi-structured interview guide which included open-ended grand tour questions as well as closed-ended questions to clarify responses. Questions assessed knowledge, attitudes, and beliefs about PrEP (e.g., Who should use PrEP; in what medical settings should PrEP prescription take place), current practices (e.g., Do you regularly prescribe PrEP to your patients), and barriers and facilitators to prescribing (e.g., In your opinion, what are the biggest barriers to PrEP uptake in the medical community generally; what about in your local medical community in particular). We also inquired about how providers receive best practice information, how and from whom they prefer to receive it, which providers are likely to be most influential in changing prescribing behaviors generally, and the type of intervention they might be willing to participate in.

The study team developed the guide based on organizational domains found to influence implementation of evidence-based practices. These included provider characteristics (e.g., knowledge, attitudes, and beliefs; training and self-efficacy; and stigma), clinic/healthcare system factors (e.g., policies or procedures that could influence prescribing), and patient factors (Damschroder et al., 2009). We also included questions that would inform a network-based intervention, such as preferred and influential sources of practice information. Interviews lasted from 30–45 minutes. Respondents were emailed a \$75 Amazon gift code for their participation. All procedures were approved by the RAND Human Subjects Protection Committee.

Analysis Plan

Consistent with rapid thematic analysis methods (Gale et al., 2019; Hamilton & Finley, 2019; McNall & Foster-Fishman, 2007; Riley et al., 2013; Taylor et al., 2018), we developed a comprehensive coding spreadsheet with domains for all topics covered during the provider interviews. Two team members read the transcripts and summarized key points for each domain within the spreadsheet. Three additional team members read all transcripts and summaries and then wrote individual summaries of themes (ideas or topics discussed by three or more interviewees) that coalesced in the following domains: 1. Provider Knowledge, Attitudes, and Beliefs about PrEP; 2. Barriers to PrEP Prescribing; 3. Facilitators of PrEP Prescribing; and 4. Opinions about Social Network-Based Intervention to Increase PrEP Prescribing. All team members met to discuss themes. Themes agreed upon by the consensus of the group were retained and are presented in the results below.

Results

Participants Characteristics

Table 1 illustrates the characteristics of the eleven low-probability/high-prescribers and five high probability/low prescribers interviewed. Medical Doctor (MD) and Nurse Practitioner (NP) providers on average were very experienced as they had worked for more than 10 years in their medical practice. More than half of the low-probability/high-prescribers were nurse practitioners (NP), while most high probability/low prescribers were MDs. Respondents worked in a variety of settings, such as family practice, federal qualified health centers, and university student health clinics.

Qualitative Themes

Themes (i.e., topics raised by 3 or more of all respondents) that emerged within the four domains are described in detail below and illustrative quotes are provided in Table 2.

1. Provider Knowledge, Attitudes and Beliefs about PrEP

Theme: Providers believe PrEP is effective but are unsure exactly how effective: Most respondents expressed the belief that PrEP is effective in preventing HIV, however some were not fully aware of statistics about its effectiveness. Two providers cited statistics that were not consistent with actual prevention rates (if taken daily, 99% reduction risk of obtaining HIV through sex and 74% reduction in risk through injection drug use (Centers

for Disease Control and Prevention, 2019). This misconception could reflect a lack of knowledge or an underlying skepticism about its efficacy.

Theme: PCPs should be prescribing PrEP: Most respondents strongly believed PCPs should be prescribing PrEP. Respondents expressed that PCPs are the right types of providers to prescribe PrEP (compared with other types of providers, such as infectious disease specialists) and that they should be prescribing PrEP. A few providers also noted that all types of providers should prescribe, including ER, urgent care, OBGYN, mental health, pediatricians, and family practitioners in addition to infectious disease providers.

Theme: Side effects and adherence are concerns, but concerns do not affect prescribing: When prompted (i.e., the interviewer asked, “what are your concerns about PrEP?”), most providers expressed some concerns, but these concerns did not seem to affect their enthusiasm about PrEP or their willingness to prescribe it. Concerns mentioned most frequently were side effects (e.g., kidney functioning and bone loss), lack of adherence, and patients using PrEP having unprotected sex that could lead to contracting syphilis or other STIs. One provider expressed concern about patients who only take PrEP intermittently when they are with high-risk partners.

Theme: Providers have high PrEP knowledge but have some misconceptions: While the majority of providers in both groups were well-versed in PrEP and most were confident in their ability to prescribe and manage patients on PrEP, some providers’ comments indicated misconceptions about patients who should be targeted for PrEP. For example, one provider suggested that all patients who are LGBTQ would be good candidates for PrEP regardless of their sexual activity; another indicated that they believe it is indicated for all patients, again not basing it on their sexual activity. Another provider mentioned being more restrictive in who they prescribe to in that they only prescribe PrEP for those believed to have “significant risk.”

2. Barriers to PrEP Prescribing

Theme: Clinic structure and policies can be barriers to PrEP prescribing: While all providers regardless of prescribing practices were strong advocates of PrEP, low-prescribers in particular said they were currently prevented from prescribing because of clinic policies or requirements. Three of the five low-prescribers cited system- or clinic-wide policies requiring that patients be referred to specialty clinics or providers, such as an infectious disease specialist, to receive PrEP. Providers mentioned that the time lag when referring patients to a different provider or outside clinic typically results in attrition. Some providers who may not feel fully up to speed reported referring PrEP candidates to a practice “champion” – a provider with a large panel of male patients currently prescribed PrEP.

Theme: Discomfort discussing sexual behaviors and STI and homophobia inhibit prescribing: Some respondents suggested that other providers’ discomfort around discussing sexual behaviors could inhibit PrEP prescribing. One provider suggested that PCPs aren’t having conversations about sex, STDs, or HIV due to their own discomfort and possibly stigma towards MSM. Another provider suggested that conservative attitudes might

prevent providers from discussing certain risk factors, including different types of sex and having multiple partners. A third, a PrEP advocate but low-prescriber, contemplated their own discomfort asking about sexual behaviors, citing feeling conflicted about the MeToo movement and opening themselves up to being accused of inappropriate behavior.

Theme: Lack of provider knowledge/awareness of/training around PrEP are prescribing barriers: Providers expressed their belief that knowledge deficits about PrEP, such as which patients are appropriate (and need or want PrEP) and about the standard of care, and the lack of protocols for prescribing all impede screening patients for and prescribing PrEP. Providers suggested that this is because PrEP is a relatively new medication and there aren't currently continuing medical education (CME) courses offered. In addition, some said that PCPs may believe it is the responsibility of infectious disease doctors, so they do not take the time to learn about it.

Theme: Community and provider stigma are barriers to prescribing: A few respondents noted that patients may not feel comfortable discussing PrEP with their PCP because they fear possible stigma around sexuality or HIV. One respondent suggested patients may feel they have to go a specialized health care facility, such as an STD clinic or an LGBTQ health center as they may feel they are less likely to experience stigma in these settings. However, another thought that patients might actually experience more stigma from going to an STD clinic or LGBTQ health center, if they are less comfortable with their sexuality and do not wish to be seen in such settings.

Some providers worried that patients may experience stigma due to attitudes towards sexual minorities in some areas (e.g., rural, more conservative communities) and thought that provider concerns around initiating conversations about sexual health in these regions could be a barrier to "small town doctors" prescribing.

Another respondent expressed that some non-prescribing providers may think that PrEP encourages risky sexual behavior because patients might have sex more frequently if they were prescribed PrEP. This provider recalled that one of their patients referred to themselves as a "Truvada whore," seeming to support this misconception, though the term is most often used to indicate a position supportive of well-informed, protected sexual behavior. The provider then expressed their own belief (perhaps stigmatizing in and of itself) that PrEP may encourage patients to "have sex with as many people as they want."

Theme: Social determinants of health are barriers to patients taking PrEP: Providers discussed several social determinants of health that are perceived as barriers to patients being able to take PrEP. A few providers specifically mentioned cost as barrier, citing the inability of some patients to obtain PrEP if they are not on Medicaid.

Providers also discussed that people who have mental illness, substance use disorders, or individuals who are struggling with housing have challenges in accessing medical care and thus are not offered PrEP. These individuals may not even be aware of PrEP as an option for preventing HIV. A few providers brought up that rural areas are underserved, also limiting patients' access to PrEP.

Some providers mentioned the extensive paperwork related to pharmaceutical company-run patient assistance programs designed to help patients obtain financial assistance in obtaining PrEP. One provider noted that care coordinators and navigators often can facilitate this work but not having this help could be a barrier to some providers prescribing.

Theme: Complexity and time impede PrEP uptake: Despite most respondents themselves stating they were champions of PrEP, they speculated that providers who do not prescribe believe that PrEP is complicated to provide and, despite its preventive function, that it requires an infectious disease specialist because it is related to HIV. These respondents agreed that PrEP takes a lot of time because of required lab work and follow-up and that PCPs who were already “stressed to the max” might not be able to take on the additional administrative overhead. According to these respondents, PCPs already have too much on their plate; adding PrEP is just one more thing to do that they do not have time for. One provider mentioned how time constraints compel PCPs to prioritize other patient concerns, leading to a lack of time for discussion about PrEP.

Theme: Privacy concerns may impede providers’ ability to prescribe PrEP to younger patients: Some providers mentioned that youth, particularly high-school and college students, often share insurance with their parents, which limits their privacy. As a result, they face the barrier of parents potentially seeing their HIV and STD test results.

3. Facilitators of PrEP Prescribing

Theme: Provider education, background and experience facilitate PrEP prescribing: Respondents commonly cited their own background, education, and personal experiences as reasons for their increased PrEP prescribing. A few respondents described previous experience in STI clinics increasing their awareness of HIV prevention and treatment efforts. Some respondents also shared that they feel personally passionate about and committed to HIV prevention, which facilitates higher prescribing.

Other respondents explained that they had received specific training/mentorship on PrEP prescribing, including participation in a virtual community of practice and learning (e.g., ECHO).

Theme: Clinic structure and policies can support PrEP prescribing: Whereas low-prescribers described clinic structure and policies as barriers to their current prescribing, most of the 11 high-prescribers mentioned that the structure of their clinics has created an opportunity for PrEP prescribing. Structures that support PrEP prescribing include shifting PrEP-related practices to designated, non-physician staff, placing a high priority on PrEP, and clinic workflows that incorporate PrEP-related procedures. A few respondents discussed additional clinic practices and materials that facilitate PrEP prescribing, including an intake questionnaire that includes questions about sexual history, posters and brochures about PrEP in the waiting room, publicizing sexual health care on the clinic website, and a triage system that enables highest-risk patients to get expedited access to PrEP.

Theme: Characteristics of patient panels facilitate increased PrEP prescribing: A few respondents suggested that the makeup of their patient panel facilitates higher PrEP

prescribing, either because their panel is more likely to ask about PrEP or because their panel is more likely to fall into a PrEP-eligible group. Two of these respondents work in university health clinics, where patients are primarily younger and are more concerned about sexual health (versus, for example, cardiovascular health). Another respondent's high sexual and gender minority patient panel was cited as a PrEP prescription facilitator. Most of these respondents shared that their patients occasionally ask about PrEP themselves instead of waiting for the doctor to offer the information.

4. Social Network Intervention Opinions and Recommendations

Desired Best Practice Information: We asked providers what type of best practice information would be helpful to PrEP prescribing. Below we list topics mentioned by at least 3 providers.

PrEP standard of care information would help PrEP uptake: All providers thought that information about PrEP and the standard of care for providing PrEP could help increase uptake. Specific information suggested by providers included evidence in support of PrEP, a prescribing protocol or “cheatsheet,” and shared-decision-making tools.

Evidence: Providers suggested centralized and standardized information about HIV risk, PrEP efficacy, ease of use, and safety could address general lack of education and awareness surrounding PrEP as well as variation in perceived efficacy.

Prescribing protocol “cheat sheet”: A few respondents expressed an interest in having a small card that listed prescribing protocol and brief but thorough guidelines. They recommended that it include an explanation of what PrEP is; who are good candidates for PrEP and examples of high-risk behaviors; how PrEP should be prescribed; side effects and a protocol for how to manage PrEP if side effects arise; and information about necessary follow ups and lab work. Providers said they could carry around the card or put it on their lanyard.

Shared decision-making/patient communication information: Some providers wanted to know the best way to deliver information to patients and how to enlist them in shared decision-making. They noted that delivery of information is an important part of the process.

Sharing prescribing rates among comparable providers could influence prescribing: Some providers mentioned that they would be amenable to receiving messages about their personal PrEP prescribing rates as well as rates of peers and experts. However, while most were open to receiving the information, mixed opinions existed about whether or not receiving prescribing rates would influence or change provider prescribing practices.

Preferred Information Sources: We asked providers which providers or types of providers would likely influence their prescribing practices. Below we list sources mentioned by at least three providers.

Influential MDs and government agencies: All respondents said that information delivered by influential physicians (e.g., epidemiologists, infectious disease doctors, researchers, other

external expert physicians) is impactful. They cited such subject matter experts as reputable sources of current practices information and guidance. One respondent noted that the Centers for Disease Control and the National Institutes of Health are trusted, influential information sources. Reputable institutions such as local public health departments, medical and academic associations, and universities were also mentioned.

Providers who already prescribe PrEP: Most providers indicated that the most influential information sources typically are PCPs who are already prescribing PrEP, who are aware of sexual and gender minority issues, or who are site-level champions. Peers who work in a similar role with comparable patient populations would likely be influential. Providers felt that seeing individuals in the same role prescribing would further convince providers prescribing PrEP is feasible for them as well.

Information from pharmaceutical representatives is not desired: When asked whether pharmaceutical representatives were an influential and desired source of practice information, respondents unanimously agreed that they are not. Although providers recognized pharmaceutical companies' contribution to public health, they expressed suspicion due to their financial motivations.

Preferred Delivery Mechanisms: We asked providers how they would prefer to receive information about best practices. Providers overwhelmingly cited CME generally and CME via video or telephone app as the most preferred delivery mechanisms. Most providers also mentioned that they do not want to receive this information through email.

The best information source is continuing medical education (CME) courses: Almost all respondents said that the best source of information is through CME courses. CME was noted as the most consistent source of receiving information about new and current practices for providers. A few providers suggested offering free CME credit, as the provider would have to cover the cost unless it was paid for by the employer. Several respondents suggested CME be delivered through videos, brief webinars, and apps so that they can easily navigate them on their phones.

Receiving information through email is not desired: Most respondents said they do not want to receive information by email, citing the overwhelming number of emails received on a regular basis. Nevertheless, one provider suggested information could potentially be provided in a weekly email roundup that provided all relevant prescribing information. Another noted that messages from reputable information sources with a heading that "grabs your attention" might be acceptable.

Discussion

Our qualitative inquiry of PCPs with high probability of prescribing but low-prescribing rates and low probability of prescribing but high-prescribing rates yielded important information about PCP knowledge, attitudes, and beliefs about PrEP, including barriers and facilitators to PrEP prescribing. This information is useful to inform general and network-

based interventions to increase PrEP-prescribing among PCPs, particularly with respect to targeting, intervention content, and mechanism of delivery.

Among this group of PCPs, providers in both groups (low probability/high-prescribers and high probability/low-prescribers) were mostly self-described PrEP advocates. They had a fair amount of knowledge about PrEP, were in favor of more PCPs prescribing PrEP, and had only minor information gaps and misconceptions about PrEP (e.g., some were not certain of exact efficacy rates and some either had expansive criteria or restrictive criteria for PrEP candidates). A higher proportion of misconceptions was noted among the low-prescribers, but since there was a small number of low-prescribing providers in this study this difference may not be meaningful.

As noted above, like the high prescribers, low prescribers also were strong PrEP advocates, with most reporting having previously prescribed PrEP. The low-prescribers also supported increased prescribing among PCPs. PrEP prescribing in both groups was either facilitated (high-prescribers) or limited (low-prescribers) by clinic structural factors, such as formal policies that require patient referral to an infectious disease specialist or a community health clinic for PrEP, or informal clinic policies that divert PrEP candidates to a practice champion. Low-prescribers indicated they would be prescribing PrEP more frequently if their clinic structure or policies supported it. Intervention content could include suggestions for how to address clinic structure and update policies to facilitate PrEP prescribing behavior; this information can be promoted by an influential source, albeit change of this magnitude would likely require the use of a highly visible proponent for larger medical systems to initiate change.

Aside from clinic structure, perceived barriers discussed by respondents tended to be about barriers they speculated other providers (not themselves) may be facing. It is also possible that they may also have been experiencing some of these barriers but felt more comfortable assigning them to others. Largely consistent with previous work, we found provider-identified barriers to providing to PrEP to include: discomfort discussing sexual behaviors and sexually transmitted infections with patients (Rucker et al., 2018; St. Vil et al., 2019), a lack of awareness or knowledge about PrEP (Pleuhs et al., 2020), a need for more training about how to provide PrEP services (Bleasdale et al., 2020; Clement et al., 2018), community- and provider-level homophobia and stigma towards people who are typically candidates for PrEP (Pleuhs et al., 2020), and patient barriers that might limit the ability to initiate or adhere to PrEP, such as low income, housing instability, and substance use (Pleuhs et al., 2020). The complexity of PrEP care, including the follow-up requirements, also was discussed by some participants as a barrier, but this may also be due to lack of knowledge, training, and adequate structural support. This suggests that providers may benefit from additional training and materials that include scripts, intake questions, role plays, etc., that have been developed and shared as part of continuing medical education by providers that have experience providing PrEP, particularly other PCPs. Another potential avenue for additional provider training is through the expansion of HIV and PrEP training among medical students and residents (O'Neil et al., 2021; Przybyla et al., 2021).

The most commonly mentioned facilitators of PrEP prescribing were provider education, background, and experience; several providers referred to their own passion for and dedication to HIV prevention as a driving force behind their own practices. While clinic structure and policies were mentioned as significant barriers for low-prescribers, high-prescribers noted that these were strong facilitators. A small number of providers also noted that characteristics of their patient panels facilitated prescribing. These providers discussed having panels that consisted mainly of patients who tend to be good candidates for PrEP, such as college students and MSM. This suggests that an intervention might focus on promoting routine screening to aid in the rapid and routine identification of patients who may be at risk for HIV but who do not reside in commonly known risk groups. Preliminary evidence suggests that routine screening in primary care can aid in the rapid identification of potential PrEP candidates that may otherwise be missed (Storholm et al., 2021).

While eliciting feedback about a possible PrEP network-based intervention, providers unanimously agreed that “best practice” information should include standard of care prescribing information. Several respondents mentioned the need for a “cheat sheet” with best practice information printed on a portable card. Most respondents also thought that providing information about prescribing rates—providers’ own rates and those of PrEP experts—could motivate providers to prescribe more. One respondent, citing the usefulness of receiving feedback on their own prescribing, explained that physicians “always think they are doing better than they are.” This suggests that sharing PrEP prescribing peer norms among providers with similar practices and allowing for social comparison may be a useful intervention for increasing prescribing behavior. These findings suggest that a network-based intervention could include up-to-date statistics on HIV incidence and PrEP prescribing (e.g., provider dashboards) to provide an opportunity for peer comparison, perhaps delivered by a provider or institution considered to be influential, such as an infectious disease specialist or the CDC

From a social network perspective, providing best practice information, cheat sheets, and the use of dashboards for social comparison may help to facilitate the transmissibility of comparable physician behaviors and best practices, making it easier to adopt PrEP prescribing behavior and adjust professional norms and attitudes. Further, getting local prominent physicians or specialists to run continuing medical education workshops could help to forge new relationships that could serve as conduits for adoption. In addition to the immediate benefit that training might provide, fostering connections between local PCPs may create lasting relationships, serving as additional channels of influence that would help to further drive the adoption of PrEP prescribing after the workshop.

Respondents were unanimous in their most preferred source of information about prescribing practices—all providers indicated that information from leading physicians and government agencies like the Centers for Disease Control have the most influence on their own prescribing practices. Many providers also indicated that information from PCPs already prescribing PrEP in similar clinical settings (i.e., in busy primary care practices) also would be influential. The majority of providers indicated that they would prefer to not receive this information from pharmaceutical companies.

This small group of providers offered in-depth insights into several impediments to PrEP prescribing that could be contributing to low prescribing rates. The barriers and facilitators discussed suggest that a network-based intervention designed to improve provider knowledge and self-efficacy by shared information from influential providers would be well-received and could help increase prescribing. However, without addressing clinic-level barriers, such as policies that prevent prescribing among PCPs and community- and provider- level stigma, such an intervention may not have its intended impact.

All told, these recommendations help define appropriate targets for strategic interventions to increase PrEP prescribing, the most influential sources and key mechanisms, and possibly the best contexts. All of these factors must be considered in creating effective interventions that take advantage of network-based features rather than more general broadcast interventions or pharmaceutical detailing.

Limitations

Findings from this exploratory study should be interpreted with consideration of its limitations. The sample was selected by “cold-calling” high- and low-prescribing providers identified through claims data with contact information coming from the NPI database. Reaching providers in this manner posed several challenges, including incorrect contact information and low response rates from providers. Moreover, there were challenges inherent in asking providers who are not implementing an evidence-based practice (i.e., low prescribers) to participate in a discussion about their lack of uptake. We believe the somewhat greater response rate from the high prescribers was due to their strong belief in the value PrEP provides for preventing HIV infection as well as their active role in providing it to their patients. These providers may have been more motivated to discuss PrEP and its uptake. Conversely, low prescribers not only rarely prescribe it, but they also may not have been well-versed in its efficacy and may hold some of the biases and stigma that respondents noted as barriers to prescribing. Therefore, they may have thought they did not have relevant information to provide, reducing their interest in participating in the study. The low-prescribers that did participate were like the high-prescribers in their strong support of PrEP, and most had, at one point, prescribed more PrEP. Thus, the sample was heavily biased towards providers who support PrEP and want to facilitate increased uptake. Of note, low response rates are common to cold-calling and in survey research with health care providers (Cho et al., 2013; Cull et al., 2005). Typical survey response rates for health practitioners vary but typically are low with a downward trend (Cho et al., 2013), and response bias is common (Cull et al., 2005). Ultimately, time, budget, and lack of success obtaining low-prescribers through the cold-calling method limited our ability to assess the low-prescribing providers. While a small sample of low-prescribers was obtained, we note that similar themes were presented across all the interviews suggesting that saturation was likely to have been reached within this sample of mostly PrEP-advocates.

Conclusions

PrEP holds promise of being the most innovative prevention strategy for individuals who are at risk for exposure to HIV since the “treatment as prevention” strategy began. Unfortunately, uptake of PrEP has been relatively low among populations most at risk

for HIV. Primary care settings are one promising avenue for the provision of PrEP to patients who may be unaware that they are at risk for HIV and that PrEP is available and affordable to them. The current study was innovative in the utilization of national claims data to specifically target PCPs highly likely to have PrEP-eligible patients in order to assess their knowledge, attitudes, and beliefs about PrEP. In addition, the study uniquely explored barriers and facilitators to PrEP prescribing with the goal of informing network-based interventions. The most salient barriers reported were clinic structure and prescribing policies prohibitive of providing PrEP; provider discomfort discussing sexual behaviors and sexually transmitted infections with patients; lack of provider knowledge, awareness of, and training on, the provision of PrEP; community- and provider-level homophobia and stigma towards people who are typically candidates for PrEP; and the perception that patient barriers such as low income, housing instability, and substance use, limit their ability to initiate or adhere to PrEP. The complexity of PrEP prescribing, including the need for ongoing labs and the follow-up requirements, also was discussed by some participants as a significant barrier, but it was suggested that this might also be due to lack of knowledge, training and adequate structural support. Importantly, PCP's suggested facilitators of PrEP prescribing are likely to be provider education, background, and experience, as well as their own passion for and dedication to HIV prevention. Findings suggest that network-based interventions delivered by influential physicians and PCPs already prescribing PrEP in similar clinical settings along with evidence provided by reputable physicians and organizations (like CDC) could improve PrEP-prescribing rates among PCPs.

Findings from this study have the possibility, if built into effective interventions, to increase PrEP access and availability for populations most at risk for HIV but who may confront their own internalized stigma, fear of seeking medical care or actively engaging with their healthcare provider, and concerns about the cost and availability of PrEP. Ultimately, findings may help reduce rates of new infection and HIV prevalence.

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Table 1:

Respondent Descriptors

Descriptor	Low Probability, High-Prescribing N=11	High Probability, Low Prescribing N=5
	N (%) or Mean	N (%) or Mean
Provider Type		
MD	5 (45%)	4 (80%)
NP	6 (55%)	1 (20%)
Average Years Since Residence/training		
All PCP	13.3	16.6
MD	11.2	19.5
NP	15.0	5.0
Gender Identity		
Female	9 (82%)	2 (40%)
Male	1 (9%)	3 (60%)
Non-Binary	1 (9%)	0

Table 2:

Themes and Illustrative Quotes

Domain/Theme	Illustrative Quotes
Provider Knowledge, Attitudes and Beliefs about PrEP	
Providers believe PrEP is effective but are unsure exactly how effective	<i>"I guess I've heard it's extremely effective. When I say extremely – excuse me, I actually don't know the exact numbers. But I would imagine based on just memory that probably I'm going to say 75–80% effective."</i> – High probability, low-prescribing provider (ID 16)
PCPs should be prescribing PrEP	<i>"It's part of our job as physicians and as PCPs. I don't think It's something like special or niche. I think It's just we're all trained to be - I mean especially as a primary care doctor part of what we do is disease prevention and health maintenance. And I think this is just - this is just like a huge opportunity to make such a profound impact on somebody's long-term health and wellbeing by offering them a once-a-day medication that could prevent them from still a very stigmatized lifelong illness. So, to me it just seems like common sense, obvious, easy."</i> – Low probability, high prescribing provider (ID 07)
Side effects and adherence are concerns, but concerns do not affect prescribing	<i>"Well, I've had several people who have asked me for PrEP and we talked about PrEP and they take it for a short period of time because they feel that partner is a risk to them. And then, they have it. And then, they come back again when they get a new partner that they think is at risk for them. And I'm a little bit concerned about the starting and stopping it. Then I'm seeing people wanting to do and also, I think that some of them are using it with only the ones they think are high-risk, but that there may be having other high-risk partners."</i> – Low probability, high-prescribing provider (ID 15)
Providers have high PrEP knowledge but have some misconceptions	<i>"I've heard that it can be used by both men and women to prevent it [HIV]. And that it could be given to women who are prostitutes or have multiple sexual partners, as well as men who have multiple partners and are at risk."</i> – Low probability, high-prescribing provider (ID 15)
Barriers to PrEP Prescribing	
Clinic structure and policies can be barriers to PrEP prescribing	<i>"When a patient has a lot of questions or they've never taken it [PrEP] before, I often do refer to my colleague that I referred to earlier. Because he's just more up to date on it and it's more of a specialty of his.... We're a small clinic, so I often refer to my colleague who has a larger gay male population in his practice."</i> – High probability, low prescribing provider (ID 16)
Discomfort discussing sexual behaviors and STI and homophobia inhibit prescribing	<i>"And there's a lot of physicians who are fairly conservative when it comes to their personal beliefs and values which limits their comfort level in those things. A lot of physicians and providers who don't feel comfortable talking about sex at all."</i> – Low probability, high-prescribing provider (ID 11)
Lack of provider knowledge/awareness of/training around PrEP are prescribing barriers	<i>"A lot of providers aren't educated about PrEP; it is not a typical continuing education topic. Unless people experience it in training programs at their residency, they tend to forgo learning about new topics, and PrEP is relatively new. There is a perception amongst many providers that anything to do with HIV is for an infectious disease specialist, although prevention falls in primary care. Most don't have experience prescribing PrEP and don't necessarily want to learn about them, because of potential side effects like nephrotoxicity, or they aren't sure about complications. There is a perception safe sex and condom use is good enough."</i> – High probability, low-prescribing provider (ID 14)
Community and provider stigma are barriers to prescribing	<i>"So, I think there's some people that are concerned about their risk, I think there are some people that are worried that the patients will be stigmatized if they're on PrEP, so especially in a small town that that could be more of a concern if you have one pharmacy and everybody knows everybody. And I think that's a bigger issue for smaller town doctors."</i> – Low probability, high-prescribing provider (ID 09)
Social determinants of health are barriers to patients taking PrEP	<i>"Now, I have to say, I think that It's expensive. And I think that's a big problem. And that – that's a barrier for – because while the Gilead Company and their drug reps maintain that anyone who wants to be on Truvada can get it free, It's not easy, It's complicated, there's lots of paperwork. there's CAP[community assistance program] – I don't, you know, you're familiar with Truvada, so there's the CAP card that gets you a discount."</i> – Low probability, high-prescribing provider (ID10)
Complexity and time impede PrEP uptake	<i>"PCPs have too much on their plate or see PrEP as something specialized. Also, PCPs and clinics limit the amount of time physicians spend with patients, which makes time for PrEP discussion challenging. Also, the</i>

Domain/Theme	Illustrative Quotes
	time for testing and follow up.” – Low probability, high-prescribing provider (ID 05)
Privacy concerns may impede providers' ability to prescribe PrEP to younger patients	“The other half have their healthcare insurance under their parents. And if we do some testing for sexually transmitted infections, we always tell our students should know the explanation of benefits that their parents may receive could include the fact that they had screening for gonorrhea, screening for chlamydia.”... But a handful of students will say, I don't want my parents to know. In that case, we do have some discount or what we call client pricing from our lab, which is quest labs. So, some of those students opt to pay out of pocket. And certainly It's kind of rubs me the wrong way that these students are insured, but then they have to pay out of pocket just because of the insurance companies policy to send an explanation of benefits, to the parents, which may include information that the student may not want their parents to know.” – Low probability, high-prescribing provider (ID 13)
Facilitators of PrEP Prescribing	
Provider education, background and experience facilitate PrEP prescribing	“I worked in [a low-income sexual health] clinic because I grew up very poor and I feel that the poor patients and patients with no insurance should be treated just as well as patients with insurance. And with much respect and dignity as other patients should be paid. And so, I felt like going into that clinic was the way for me to know offer those services and provide positive care for a lot of people who are at risk.” – Low probability, high-prescribing provider (ID 15)
Clinic structure and policies can support PrEP prescribing	“My program is committed to giving out PrEP. It's a decision that we made as part – It's a disease control program. So, we were committed to doing that. And we have not only a social worker doing all the paperwork and the support work. But when I go to the clinic to do PrEP, have someone drawing the bloods for me. And – which includes creatinine and – well, when they first start in my – include a hepatitis screen, liver function tests, creatinine etc. So not only is there a social worker helping, there's lab supports. So, I'm in a program that's truly committed. And if patients don't show up for an appointment, someone calls, they get reminders.” – Low probability, high-prescribing provider (ID 10)
Characteristics of patient panels facilitate increased PrEP prescribing	“Well, I mean I think It's easy in college health where we're at -I mean the main focus that a lot of these kids have is about sex, and also - and risky behaviors. And so, we wouldn't be doing our job in college health if we're not addressing these issues. So I think It's this nature of doing college health for the past 15 years, this is where I'm most comfortable, compared to like give me a patient with heart failure and I'll be like, 'Oh my god, I don't know what to do.'” – Low probability, high-prescribing provider (ID 09)
Social Network Intervention Opinions and Recommendations	
Desired Best Practice Information	
PrEP standard of care information would help PrEP uptake	“One mistake we often make with any clinician we get is given to us in a non-evidence-based delivery method. So, the method that I would want it, not how people usually do it. I would want to know among patients – among gay males the risk of HIV is – for the standard person is one in 100, and should they take PrEP, the risk then would go down to one in 10,000.” – High probability, low-prescribing provider (ID 16)
Sharing prescribing rates among comparable providers could influence prescribing	“Yeah. Oh, absolutely, absolutely, because I as physicians, we always think we're doing a lot better than the reports. Okay, maybe I need to really need to do better. So yeah, I think that It's very insightful for us to get that information.” – Low probability, high-prescribing provider (ID 13)
Preferred Information Sources	
Influential MDs and government agencies	“I think that if someone was still skeptical about the practice to begin with, they would want to hear from an infectious disease researcher and epidemiologist, who can say from the fact that they've read all the studies and that it is, that works.” – Low probability, high-prescribing provider (ID 04)
Providers already prescribing PrEP	“Yeah, so I would say I want to - I'm a PCP. I want to hear from another PCP just how straightforward this is and how they work it into all of the other things that on a plate.” – Low probability, high-prescribing provider (ID 04)
Information from pharmaceutical representatives is not desired	“Leading experts first, peers, second [as preferred information sources] and pharmaceutical companies. Yeah. The pharmaceutical companies they're out there. But I think a lot of physicians especially myself, we have this general distrust of the pharmaceutical companies because we feel that their bottom line is a financial as opposed to a patient care. However, that's certainly a jaded perspective on my side because I know the pharmaceutical companies do so much for our patients, whether It's a patient assistance program, support, educational, opportunities for patients. So, they do a good job there. But I still would certainly go,

Domain/Theme	Illustrative Quotes
	<i>put my trust in an unbiased expert in the field.”</i> – Low probability, high-prescribing (ID13)
<i>Preferred Delivery Mechanisms</i>	
The best information source is continuing medical education (CME) courses	<i>“Particularly like when we get them for free, like the National STD Curriculum like when you do their CME stuff, you get free CME for that. They don’t have one though on PrEP. So free CME is like a huge motivator at least for me because it adds up.”</i> – Low probability, high-prescribing provider (ID 11)
Receiving information through email is not desired	<i>“I feel like we get inundated with emails, and I don’t send - if an email is not from somebody I know or, you know, I tend to not read them, I just delete them.”</i> – Low probability, high-prescribing provider (ID 09)