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SUBSTANTIVE REVIEW

Pharmacy-Based Interventions to Increase Use of HIV Pre-exposure Prophylaxis in the United States: A Scoping Review

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Abstract

HIV pre-exposure prophylaxis (PrEP) remains underutilized in the U.S. Since greater than 85% of PrEP prescriptions are filled at commercial pharmacies, pharmacists are uniquely positioned to increase PrEP use. This scoping review explores pharmacy-based initiatives to increase PrEP use. We searched PubMed, PsycINFO, CINAHL, and Scopus for peer-reviewed studies on pharmacist-led interventions to increase PrEP use or pharmacy-based PrEP initiatives. Forty-nine articles were included in this review. Overall, studies demonstrated that patients expressed strong support for pharmacist prescription of PrEP. Three intervention designs compared changes in PrEP initiation or knowledge pre- and post-intervention. Commentary/review studies recommended PrEP training for pharmacists, policy changes to support pharmacist screening for HIV and PrEP prescription, and telemedicine to increase prescriptions. Pharmacists could play key roles in improving PrEP use in the U.S. Studies that assess improvements in PrEP use after interventions such as PrEP prescription, PrEP-specific training, and adherence monitoring by pharmacists are needed.

Keywords Pharmacist* · Sexual health · Initiation · Adherence · Compliance*

Introduction

Oral pre-exposure prophylaxis (PrEP) for HIV, Truvada® (emtricitabine, tenofovir disoproxil fumarate) and Descovy® (emtricitabine and tenofovir alafenamide), can reduce HIV acquisition risk from sex by 92–99% when used daily [1–6]. Although PrEP use is generally increasing in the United States, with over 50,000 new PrEP users in 2018 [7], only a small proportion of high-risk populations with CDC risk indicators have initiated PrEP [8–10]. Uptake and adherence are disproportionately low among individuals clinically indicated for PrEP and in subpopulations such as sexual minority men, transwomen, cisgender women, and sex workers [11–13]. Disparities in PrEP initiation by age, race, sex, and geography are widening in the U.S. [14].

Despite increased vulnerability to HIV acquisition, only ~ 1% of clinically indicated African Americans and 3% of clinically indicated Hispanics/Latinos were actually prescribed PrEP, compared to 14% of clinically indicated Whites [15, 16]. Additionally, people in the U.S. South have a lower rate of PrEP prescription to HIV incidence than other U.S. region [8]. Regarding sex distributions, females have a lower ratio of new PrEP prescriptions to new HIV

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diagnoses compared to males [7, 17, 18]. Among those who initiate PrEP, adherence is low [19–25]. Only 50–60% of patients are retained in PrEP care after 1 year [19, 26]. Barriers to PrEP initiation and adherence include low awareness, limited knowledge, and poor perceptions of PrEP by patients and providers [27, 28]. Further, limited access due to transportation, high healthcare and copay costs, and disparities in provider prescription, all present a crucial need to expand PrEP access. Pharmacies play important roles in PrEP acquisition and adherence by facilitating access to prescriptions [29, 30].

There are approximately 67,000 retail pharmacies in the U.S., many of which offer home-delivery services, drive-through services, and multilingual staff [29]; 85–90% of PrEP prescriptions are filled at commercial pharmacies [31]. Pharmacies could bring the U.S. closer to plans for Ending the HIV Epidemic in the U.S. (EHE) by 2030 [32]. Pharmacists historically have been able to order testing and prescribe medications under: (1) collaborative practice agreements (CPAs); and (2) state laws that permit prescribing for pharmacists; however, currently, California, Oregon, and Colorado are the only U.S. states to legalize the authority of pharmacists to prescribe and dispense PrEP independently [33, 34]. Most states have legalized the authority of pharmacists to prescribe and dispense PrEP in collaboration with other healthcare providers. More states and cities have increased discussions regarding the prescriptive authority of PrEP to pharmacists, and the Veterans Health Administration (VHA) has nationally approved pharmacist prescription of numerous medications [34, 35]. Pharmacists could facilitate PrEP uptake and adherence through consultations with and HIV screening for interested individuals, point-of-care testing for HIV and other sexually transmitted infections (STIs), PrEP prescriptions, and PrEP adherence counseling. Pharmacy-based interventions such as refill reminders and adherence counseling have improved medication adherence to antiretroviral therapy regimens among people living with HIV [36–38]. Although interventions that integrate pharmacists into the PrEP care continuum are increasing [39, 40], information related to pharmacy-based PrEP interventions is limited.

To fill this gap, the purpose of this scoping review is to (1) review current evidence regarding attitudes toward PrEP and pharmacy-based interventions to increase PrEP initiation and adherence; (2) summarize findings from existing pharmacy-based PrEP interventions; and (3) identify best practices from commentaries and reviews of pharmacy-based PrEP interventions. Reviewing and synthesizing existing models for pharmacy-based PrEP interventions could provide more insight into ways to increase PrEP initiation and adherence in the U.S. Findings of this study could be used to implement pharmacy-based interventions designed to increase PrEP initiation and adherence in the U.S.

Methods

We examined research activities, summarized findings, and consolidated recommendations in the literature concerning pharmacy-based PrEP interventions. We used a 5-step approach that included the following procedures: (1) identifying the research question (i.e., what is stated in the current literature on pharmacy-based PrEP interventions), (2) identifying the relevant studies, (3) study selection, (4) presenting the data, and (5) collating the results [41]. Consistent with the goals of a scoping review, selected studies were synthesized, and gaps in existing literature were identified [41, 42].

Search Strategy

We searched within four databases: PubMed, PsycINFO, CINAHL (Cumulative Index to Nursing and Allied Health Literature), and Scopus. To identify sources concerning HIV within PubMed, we used search terms such as "HIV*" OR "Anti-HIV Agents*" OR "HIV infections*" OR "HIV/AIDS" OR "Acquired Immunodeficiency Syndrome." The terms "Pre-Exposure Prophylaxis*" OR "PrEP" were searched to focus on PrEP specifically. Additionally, sources including data on pharmacists and/or pharmacies were captured using "pharmacy*" OR "pharmacies*" OR "pharmacy residencies*" OR "pharmacy service, hospital*" OR "community pharmacy services*" OR "evidence-based pharmacy practice*" OR "pharmaceutical services*" OR "pharmacist*" as terms. To find articles referencing pharmacists' ongoing or potential roles in PrEP initiation, terms such as "HIV Testing" OR "HIV Diagnose" OR "treatment adherence and compliance*" OR "medication adherence*" OR "patient compliance" OR "counsel" OR "monitor" were used. These search terms were modified as necessary when collecting sources from various databases. Boolean logic and MeSH terms were both used to maximize candidate articles. Additionally, a manual search was conducted within the references of articles emerging from the search; these sources were included in the subsequent title and abstract reviews if appropriate. These search strategies resulted in a total of 916 articles. All data searching was conducted by one reviewer.

Articles were selected if they met the following criteria: (1) published in a peer-reviewed journal between January 1, 2012 and June 11, 2021 (2012 demarcates the year that the U.S. Food and Drug Administration first approved PrEP [43]); (2) focused primarily on PrEP in the article and presented data on the potential impact of pharmacies on PrEP acquisition and/or adherence; (3) included data

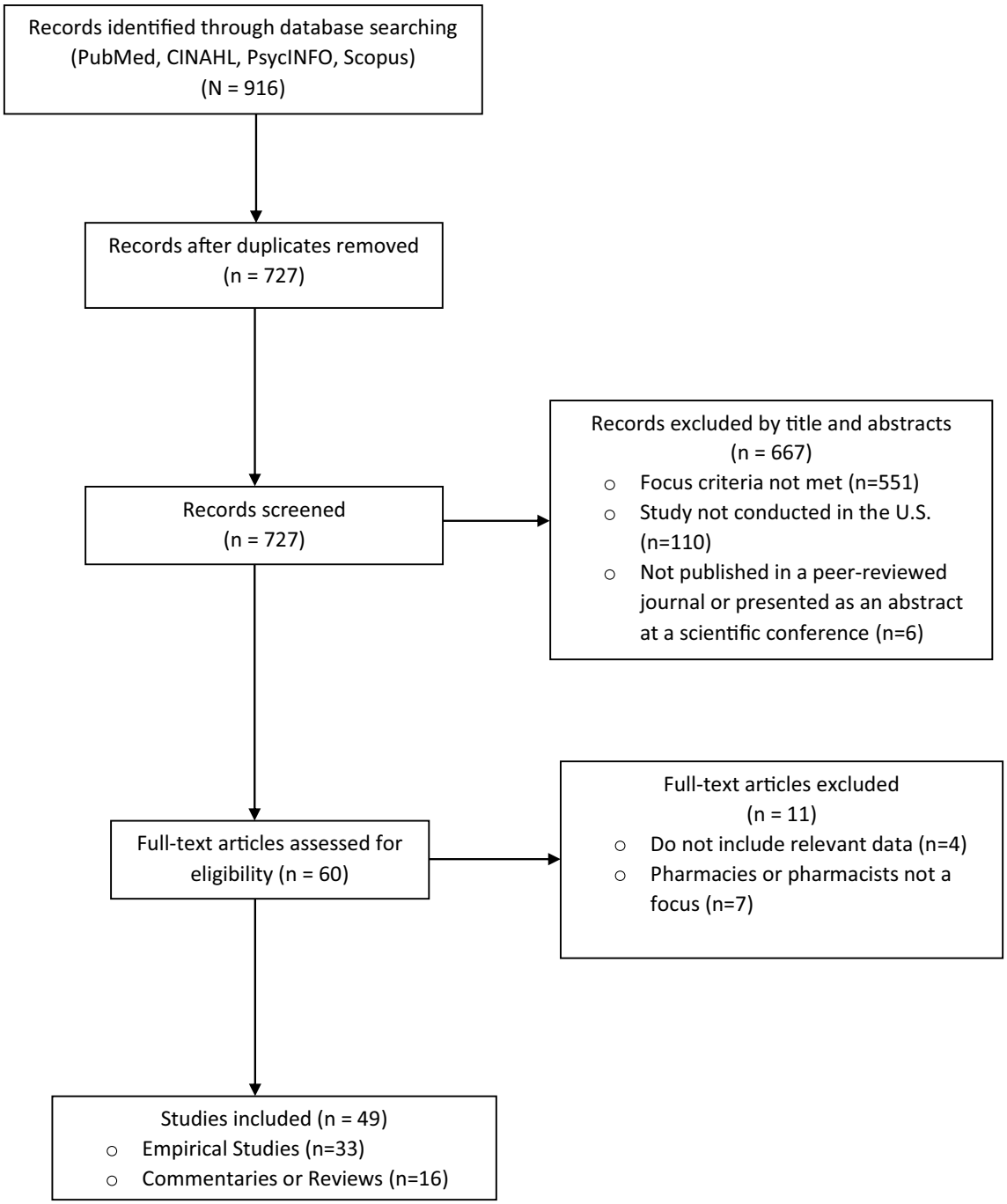

Fig. 1 PRISMA flow diagram of included U.S. studies on pharmacy-based PrEP interventions

and/or commentary on individuals eligible for PrEP or focused on PrEP administration or counseling by pharmacists; (4) conducted in the United States (Fig. 1).

Study Selection

After potential articles were collected, titles and abstracts were reviewed for relevance. We excluded candidates using the specified criteria, then subsequently conducted a full text review. Selected studies were divided into two categories upon acceptance: empirical studies, which consisted of sources containing primary observational data, and commentaries or reviews, which provided recommendations for PrEP-related interventions. Screening was conducted by two reviewers (AZ and LTD).

To visualize the geographic locations where pharmacist knowledge of and familiarity with PrEP had been assessed, where pharmacy-based PrEP interventions have been implemented, and in which states PrEP prescriptive authority for pharmacists have been legalized, a map of the U.S. was created using Notability by Ginger Labs. State and regional percentages represent those of cohorts utilized in the included studies and do not necessarily reflect state-wide and region-wide data. The grid pattern represents states that have legalized independent pharmacist PrEP prescriptive authority as of June 2021. Percentages listed for Nebraska and Iowa reflect a study in which the data from each state were not disaggregated. Stars represent areas in which pharmacist-led PrEP interventions have been implemented. HIV cases per 100,000 residents of respective state and PrEP users per 100,000 residents of respective state were listed in the image.

Results

The initial database searching yielded a total of 916 studies. After de-duplication, the remaining 727 studies were screened based on title and abstract, resulting in the exclusion of 667 articles. The most common reasons for exclusion at this stage were that the title and/or abstract did not meet the focus criteria (n = 551) or that the study was not conducted in the U.S. (n = 110). The remaining 60 articles were retrieved for full text review, and 11 were excluded because they did not include relevant data or did not focus on pharmacies or pharmacists. Forty-nine studies met the specified inclusion criteria (Fig. 1).

Empirical Studies

Pharmacist and Patient Knowledge and Perceptions of PrEP

Twenty-four empirical studies concerning pharmacist and patient perceptions of PrEP were identified (Table 1). The sample size of such studies ranged from 9 [44] to 7148 [45]. Fourteen studies contained primary observational data concerning practicing pharmacists' and Doctor of Pharmacy (PharmD) students' knowledge, perceptions, and attitudes of pharmacy-based PrEP interventions [44, 46–55]. Pharmacists and/or pharmacy students from all four of the U.S. Census Bureau regions were represented. Eight studies measured practicing pharmacist knowledge of PrEP, and pharmacist familiarity with PrEP and CDC guidelines for PrEP eligibility varied across different regions of the U.S [44, 47–50, 56–58]. Five studies measured proportions of pharmacists with familiarity on PrEP and/or the CDC guidelines for PrEP; familiarity ranged from 42% in Nebraska and Iowa to 91% in New York [47, 56]. Additionally, two other studies found that pharmacists with more years of experience were less likely to be familiar with PrEP, while pharmacists with less than 10 years of experience had the highest PrEP knowledge and intention to counsel [47, 51]. Six studies examined PrEP awareness among pharmacy students, reporting rates of PrEP awareness of up to 97.7% among final year PharmD students [53].

Eleven studies contained data concerning patient experiences with or attitudes toward PrEP pickup or prescription in pharmacies [45, 46, 59–67]. Ten of these studies targeted patients of high-risk populations, such as people who inject drugs and MSM, who were seeking to initiate PrEP. Reported barriers among these populations concerning PrEP delivery in pharmacies included a lack of medication availability, difficulty with mail refills, misinformation about medication cost, and privacy concerns [45, 46, 59–62, 64–67]. Two other studies targeted broader populations to collect general patient perspectives on the prescriptive authority of pharmacists. The first was a qualitative study, which examined the perceptions of PrEP delivery in pharmacies among MSM residing in Atlanta who were not necessarily interested in initiating PrEP [46]. Patients expressed strong support for future PrEP prescription and screening. In a second study on patients attending a grocery-chain pharmacy who were not necessarily eligible for or aware of PrEP, most patients reported no concerns regarding pharmacist prescription of PrEP [63]. One qualitative study, which included cisgender women, focused specifically on their attitudes toward long-acting injectable PrEP [65].

Pharmacy-Based PrEP Implementation Studies

Nine studies described the implementation of PrEP interventions within pharmacies (Table 2). Despite consistent data suggesting the clinical benefit of PrEP since 2007, the first studies of PrEP interventions at pharmacies were not published until 2018. In these studies, community or hospital pharmacists were incorporated into a PrEP program. Only three of such interventions included a control group [68]; the remaining studies evaluated newly implemented programs without comparison data. The most common intervention activity was pharmacist prescription of PrEP [69–74], which was well-received by patients [70]. Other activities included pharmacist facilitation of PrEP initiation via remote or telephone consultations with patients interested in PrEP [69, 71]. Four studies were designed to initiate PrEP among eligible participants, achieving successful PrEP initiation among a range of 54%-100% of participants [69–72, 74]. A separate study, which focused on retention, employed a PrEP Navigation (PN) tool to minimize the number of days between PrEP prescription and pickup, ultimately shortening this interval by 1.42 days [68]. Additionally, two studies piloted programs that allowed for pharmacists to provide

Table 1 Studies evaluating pharmacist and patient knowledge and perceptions of PrEP

Author	Year published	Study location	Study design and objectives	Study population	Key findings
Studies assessing pharmacist knowledge and perceptions					
Shaeer et al.	2014	Florida	Cross-sectional study to assess pharmacists' experiences with and perceptions of PrEP in order to determine areas in which pharmacist training is needed	Pharmacists who were recipients of the Florida Pharmacy Association's newsletter or American Academy of HIV Medicine members in Florida; Nova Southeastern University College of Pharmacy preceptors (N = 225)	•22% reported dispensing PrEP •47% were uncomfortable counseling patients about PrEP •59% were aware of FDA's expanded PrEP indication for emtricitabine and tenofovir
Unni et al.	2016	Utah	Cross-sectional study to measure pharmacist knowledge and perceptions of PrEP and intention counsel patients about PrEP	Community pharmacists recruited from the Utah Division of Occupational and Professional Licensing (N = 251)	•Pharmacists with PharmD and < 10 years of experience had higher knowledge and intention to counsel •Beliefs about capabilities and usefulness of counseling of PrEP predicted intent to counsel
Smith et al.	2016	Nationwide	Cross-sectional study on awareness and attitudes of primary care clinicians (including retail pharmacists) towards PrEP	Pharmacists who had worked in the U.S. for > 3 years (n = 251)	• 43% currently provide some services under a CPA • 57% expressed interest in on-site HIV testing for clients
Broekhuis et al.	2018	Nebraska and Iowa	Cross-sectional study to characterize pharmacists' familiarity with PrEP and willingness to implement PrEP services	• Preceptors of pharmacy students at the College of Pharmacy at the University of Nebraska Medical Center • Pharmacists practicing in Nebraska and Iowa with contact information available through the Medical Monitoring Service, Inc.'s database (N = 140)	•42% were familiar with PrEP and 25% were familiar with CDC PrEP guidelines •Older pharmacists were less likely to be familiar with PrEP •54% indicated they were likely to provide PrEP services through a CPA and with additional training
Okoro et al.	2018	Minnesota	Cross-sectional study to measure the knowledge and attitudes of pharmacists regarding PrEP, as well as to identify the PrEP training needs of community pharmacists	Community pharmacists identified through the Minnesota Board of Pharmacy (N = 347)	•54% were aware of FDA approval of emtricitabine and tenofovir disoproxil fumarate for PrEP •71% were unfamiliar with CDC PrEP guidelines •21% had sufficient PrEP knowledge to counsel patients •common concerns included identifying appropriate candidates and patient adherence
Meyerson et al.	2019	Indiana	Cross-sectional study to identify factors associated with PrEP initiation and community pharmacist comfortability with pharmacy-practice PrEP interventions	Licensed managing pharmacists (Indiana Board of Pharmacy, Feb 2016) registered with retail pharmacies (Hayes Directories, Inc. Dec 2015) (N = 284)	•16% had dispensed PrEP, and 12% had consulted PrEP •PrEP dispensing and comfort counseling were associated with confidence in PrEP knowledge

Table 1 (continued)

Author	Year published	Study location	Study design and objectives	Study population	Key findings
Przybyla et al.	2019	Buffalo, NY	Cross-sectional study to measure pharmacy student familiarity with and attitudes toward counseling patients about PrEP	Doctor of Pharmacy (PharmD) students at the University of Buffalo (N = 291)	•91% and 61% of respondents were familiar with PrEP and PrEP prescription guidelines, respectively •Familiarity with PrEP prescribing guidelines was correlated with higher odds of counseling intentions
Bunting et al.	2020	Nationwide	Cross-sectional study to investigate the extent of professional student PrEP education and whether PrEP education matched regional disparities in PrEP initiation	Allopathic medical (n = 586), osteopathic medical (n = 316), pharmacy (n = 292), physician assistant (n = 144), and undergraduate nursing students (n = 521) throughout the U.S (N = 1859)	•83% were aware of PrEP •62% of fourth-year students had received PrEP education during training •Most comprehensive PrEP education was in the Northeast
Koester et al.	2020	California	Qualitative study to assess attitudes toward pharmacists' prescriptive authority of PrEP and PEP	Clinical and community pharmacists (n = 7) and pharmacists serving in senior management positions within a large retail chain pharmacy (n = 2)	• Pharmacist-prescribed PrEP was accepted among all interviewees • Interviewees listed benefits of pharmacist-prescribed PrEP such as wide accessibility of community pharmacists and increased efficiency of healthcare workforce • Some interviewees noted concerns about implementation issues and subsequent challenges with pharmacist involvement and ordering of labs for HIV diagnosis
Rathbun et al.	2020	Nationwide	Cross-sectional survey study to assess HIV-related content delivered within pharmacy schools in the U.S	Four-year pharmacy programs in the U.S. listed in the American Association of Colleges of Pharmacy directory (N = 37)	• 100% reported covering content related to HIV in at least one required course • 89% covered material concerning PrEP
Bunting et al. (a)	2021	Nationwide	Cross-sectional survey study to assess the sources from which health professions students received knowledge of PrEP and HIV risk factors	PharmD students enrolled in health professions programs in the U.S. (n = 240)	• 98% of final-year PharmD students reported learning about PrEP • Final-year PharmD students reported a mean of 2.54 courses with exposure to HIV risk factors
Bunting et al. (b)	2021	Nationwide	Cross-sectional survey study to evaluate future health care providers' awareness of PrEP, knowledge of PrEP, and confidence in educating colleagues and patients about PrEP	Pharmacy students in health profession student societies in the U.S. between January and July of 2019 (n = 293)	• 80% of future pharmacists displayed high knowledge of PrEP • 73% of future pharmacists reported high confidence counseling a patient about PrEP • Future pharmacists were more likely to have received formal education about PrEP compared to future nurses and prescribers

Table 1 (continued)

Author	Year published	Study location	Study design and objectives	Study population	Key findings
Przybyla et al.	2021	University of Buffalo (included PharmD students) and University of Rochester (did not include PharmD students)	Cross-sectional study to assess healthcare students' knowledge and familiarity with PrEP prescription guidelines and willingness to prescribe PrEP to future patients	PharmD students enrolled at the University of Buffalo (n = 289)	• Compared to MD and Doctor of Nursing Practice (DNP) students, PharmD students reported the highest level of PrEP awareness of, knowledge of, and familiarity with prescribing guidelines • Compared to MD students, PharmD students were less comfortable with performing PrEP-related clinical activities
Studies assessing patient knowledge and perceptions					
Garner et al.	2018	Nationwide	Retrospective observational study to measure demographic and regional data for persons initiating PrEP in the VHA	Persons initiating PrEP in a VHA database (N = 825)	•67% and 76% of persons who initiated PrEP were White and MSM, respectively •Most initiations were in California, Florida, and Texas •Clinical infectious disease pharmacists accounted for 7% of PrEP initiations
Coy et al.	2019	Nationwide	Cross-sectional study to describe PrEP persistence over a two-year period	Patients who initiated PrEP at a national chain pharmacy (N = 7148)	•56% of patients were adherent for a year after PrEP initiation •Individuals of ages 18–24 had lowest PrEP persistence •Use of a community-based specialty pharmacy (compared to retail pharmacy) had higher PrEP persistence
Park et al.	2019	The Bronx, New York City	Qualitative study to characterize the pathway to PrEP for women attending a sexual health clinic	Women prescribed PrEP (N = 14)	•Self-perceived HIV risk, trusting sources, insurance coverage, and positive interactions with providers facilitated PrEP initiation and adherence •Common concerns included insurance coverage, misinformation, and pharmacy barriers •Pharmacy barriers included lack of medication availability at time of pickup and misinformation about medication cost
Sun et al.	2019	Oregon	Qualitative study to identify barriers of PrEP access	Sexual and gender minority patients currently using PrEP, seeking PrEP, or no longer using PrEP (N = 27)	•Patients reported cost/access difficulties when filling prescriptions •Pharmacies did not stock PrEP Patients faced difficulties with mail refills

Table 1 (continued)

Author	Year published	Study location	Study design and objectives	Study population	Key findings
Zhu et al.	2020	Washington D.C. and Maryland	Cross-sectional study to determine patient perceptions of pharmacist prescription of PrEP	Patients at 5 locations of a large grocery-chain pharmacy in Washington, D.C. and Maryland (N = 117)	•58% reported no concerns regarding pharmacist PrEP prescription •White clients were more likely than clients identifying as Black or another race to agree with pharmacists prescribing PrEP
Crawford et al.	2020	Atlanta, GA	Cross-sectional study to investigate willingness of MSM to discuss PrEP with pharmacy staff and screen for PrEP in a pharmacy setting	Men (18 and older) who attended Atlanta Pride events, reported same-sex behavior, had not previously used PrEP, and reported being HIV negative or had not been tested for HIV (N = 259)	• 69% of participants were willing to discuss PrEP with pharmacy staff • MSM were more likely to be willing to discuss PrEP with pharmacy staff if they were interested in PrEP • Race did not significantly impact likelihood or willingness to discuss PrEP with pharmacy staff
Philbin et al.	2021	New York, NY; Chicago, IL; San Francisco, CA; Atlanta, GA; Washington, DC; Chapel Hill, NC	Qualitative study to assess women's interest in long-acting injectable (LAI) PrEP and perceived barriers to PrEP access and adherence	HIV-negative women across six major cities (N = 30)	• Participants acknowledged accessibility of pharmacies but had preference for reception of LAI PrEP from their doctor • Commonly mentioned barriers included fear of LAI side effects and novelty
Felsher et al.	2021	Philadelphia, PA	Qualitative study to describe barriers to PrEP adherence among women who inject drugs	Cisgender women, ages 18 and older, who reported injection drug use within the last 30 days, and who were eligible for PrEP. Women had to be willing to accept a PrEP prescription from the study provider (N = 23)	• Women who inject drugs considered PrEP highly beneficial but had decreased motivation to adhere during periods of low perceived risk • Women who inject drugs who had unstable lives left them vulnerable to exploitation by predatory pharmacies
Lutz et al.	2021	Arizona	Cross-sectional study to assess patient views on pharmacist prescriptive authority of PrEP	Adult patients receiving antiretroviral medication for HIV prevention or treatment (N = 49)	• 100% agreed or strongly agreed that pharmacists are both accessible to them and knowledgeable about HIV medications • 96% of participants agreed or strongly agreed that they would ask their pharmacist about questions regarding their antiretroviral medication regimen • Most participants felt comfortable going to a pharmacist to receive a test for HIV infection and to discuss PrEP
Studies assessing both pharmacist and patient knowledge and perceptions					

Table 1 (continued)

Author	Year published	Study location	Study design and objectives	Study population	Key findings
Crawford et al.	2020	Metropolitan Atlanta area	Qualitative study to understand perceptions of PrEP delivery in pharmacies among pharmacists and MSM	MSM (n = 8) and pharmacists (n = 6) in neighborhoods in Atlanta, GA with high HIV prevalence (identified using AIDSVu)	•MSM and pharmacists both supported future PrEP prescription and screening in pharmacies •MSM and pharmacists noted necessity of training pharmacy staff
Laborde et al.	2020	San Francisco, CA	Qualitative study to examine patient, provider, and contextual factors that influence PrEP adherence	PrEP users (n = 25) and PrEP providers (n = 18) in the San Francisco Department of Public Health Primary Care Clinics	•Black/Latinx patients and transwomen mentioned barriers such as medical mistrust and stigma •Patients reported difficulty in obtaining pharmacy refills and daily adherence

PrEP and HIV prevention curriculum for both undergraduate and graduate students [75, 76].

Commentaries and Reviews on Pharmacy-Based PrEP Interventions

16 commentaries and reviews were included based on eligibility criteria (Table 3). These studies, which contained specific recommendations for future PrEP-related interventions within pharmacies, were published between the years 2012 and 2021. Twelve of the included commentaries and reviews recommended greater collaboration between pharmacists and providers [35, 40, 77–85]. Ten of the studies highlighted the utility of pharmacists performing HIV screening in order to identify HIV-negative individuals potentially eligible for PrEP [35, 78, 80, 82–88]. Two studies suggested the formation of Collaborative Practice Agreements (CPAs) that allow for the initiation and monitoring of PrEP by pharmacists [35, 82]. Additionally, two other studies suggested the formation of a Collaborative Drug Therapy Agreement (CDTA) that may similarly expand the scope of pharmacy practice to the prescription, modification, or discontinuation of PrEP [40, 80]. Such agreements would require the advocacy of policy changes that expand pharmacists' scope of practice in certain states [35]. Another common theme was the need to train pharmacists to properly provide patients with PrEP adherence counseling, sexual health counseling, and adverse side effect screening [77, 80, 82, 89–91].

Discussion

This scoping review collected existing literature on the growing potential of greater pharmacist involvement in PrEP delivery in the U.S. Studies that measured pharmacist counseling intentions and willingness to provide PrEP services noted a positive association between PrEP familiarity and counseling or prescribing intentions [46–48, 51, 56, 63]. Few studies explored pharmacist PrEP familiarity qualitatively, and there was a lack of longitudinal data displaying changes in knowledge and attitudes over time. Within studies investigating patient attitudes toward pharmacist prescriptive authority, most patients expressed support for greater pharmacist involvement in PrEP prescription and HIV screening.

Prior to pharmacist involvement in PrEP prescription and HIV screening, further data are needed to determine areas in which pharmacists need comprehensive PrEP training. Studies measuring pharmacist knowledge of or familiarity with PrEP were concentrated in the Midwest U.S., which includes states with the lowest HIV prevalence. There were no studies based in the Western U.S., and few studies based in the South or Northeast regions (Fig. 2). This could suggest incongruence between where PrEP is most needed and

Table 2 Program evaluations of pharmacy-based interventions to increase PrEP initiation

Author	Year published	Study location	Intervention description	Study population	Key findings
Tung et al.	2018	Seattle, WA	Creation of a pharmacist-managed HIV PrEP clinic in a community pharmacy setting at Kelley-Ross Pharmacy, allowing pharmacists to initiate and manage PrEP under the supervision of a physician medical director	Patients evaluated for PrEP (N = 695)	•97% of patients initiated PrEP •74% of patients began PrEP same day as initial appointment •No seroconversions to date
Hoth et al.	2019	Iowa	Pharmacists at the University of Iowa completed TelePrEP visits, arranged local laboratory studies, and mailed medications	Patients referred from the Iowa Department of Public Health personnel in STI clinics, disease intervention specialist and partner services, and HIV testing programs (N = 186)	•68% of total referrals completed video visits •91% of clients with video visits started PrEP •Retention at 6 months was 61%
Gauthier et al.	2019	Miami, FL	Incorporation of pharmacists into a hospital PrEP program structure, allowing them to order labs, consults, and medications during visits in person or via telephone	Persons eligible for PrEP in the Miami Veterans Affairs Healthcare System (N = 79)	•54% initiated PrEP by the end of the study period •Barriers to continuing PrEP included no longer at risk, loss to follow-up, and adverse reaction
Havens et al.	2019	Omaha, NE	A pharmacist-led PrEP (P-PrEP) program composed of pharmacists from a university-based HIV clinic, a community pharmacy, and two community-based clinics. A CPA allowed pharmacists to conduct PrEP visits and prescribed PrEP	Patients eligible for PrEP (N = 60)	•100% would recommend the P-PrEP program •100% of the enrollments initiated PrEP •No seroconversion of participants •Retention at 1 year was 28% •Pharmacists reported comfortability in performance of point-of-care testing
Maier	2019	Nationwide	Retrospective analysis of data on individuals initiating PrEP in the VHA	Individuals who initiated PrEP (at least a 31-day course) between July 1, 2012 and June 30, 2017 (N = 1600)	• Pharmacists authorized 6% of PrEP prescriptions among participants • Clinical pharmacists offer potential for PrEP initiation in rural areas and at facilities without academic affiliations
Coleman et al.	2020	Washington D.C	Development of PrEP navigation (PN) tool based on the Capability, Opportunity, Motivation–Behavior to organize patient-reported barriers to PrEP initiation. Support for process improvements based on PN tool findings. Measured 3 outcomes following implementation: reported barriers, demographics, and time to medication pickup from pharmacy	Patients with TDF/FTC prescription at large federally qualified health center (FQHC) (N = 198)	•Average days between PrEP prescription and pickup decreased by 1.42 days •Barriers in medicine pickup included change in risk perception, misunderstanding of mailed medication, etc
Khosropour et al.	2020	Jackson, MS	Patients eligible for PrEP were referred to an on-site clinical pharmacist for PrEP initiation and follow-up within 6 weeks	Patients presenting to Express Personal Health who tested negative for HIV (N = 69)	• 95% of participants were MSM • 100% of participants received a same-day PrEP prescription • 33% of participants were referred for same-day PrEP filled a prescription and were properly linked to PrEP care

Table 2 (continued)

Author	Year published	Study location	Intervention description	Study population	Key findings
Cannon et al.	2021	San Diego, CA	Piloted a PrEP and HIV prevention curriculum (named PrEP University) for students likely to prescribe PrEP in the future. Examined PrEP awareness and ability of curriculum to enhance PrEP knowledge	Medical and pharmacy students likely to prescribe PrEP in the future at the University of California, San Diego (n = 19 pharmacy students)	• All pharmacy students had heard of PrEP prior to the introduction of PrEP University • Pharmacy students had high levels of PrEP awareness, but lower baseline knowledge scores compared to medical students
Taliaferro et al.	2021	Washington, DC	Cross-sectional study to investigate the impact of a pharmacist-led training program designed for undergraduate students	Undergraduate students enrolled at Howard University (at least 18 years of age) (N = 116)	• Common concerns about barriers to PrEP initiation included side effects of medication, expense of medication, and insurance issues • Educational programs concerning PrEP may increase willingness to take PrEP

where pharmacists are likely to be familiar with PrEP [57]. This finding could also suggest that pharmacists in areas with high HIV rates are already familiar with PrEP, indicating a more critical need for evaluation of pharmacist knowledge of PrEP in other U.S. regions. Given that seven studies highlighted an increased need for PrEP education among pharmacists [46–51, 56], PrEP education is still needed for pharmacists in order for future interventions to be properly implemented. Training, especially in non-specialty pharmacies, may aid in pharmacist interventions targeting PrEP. These trainings should address how to establish trusting relationships with patients and how to improve pharmacist comfort with discussing patients' sexual practices.

For future pharmacists currently receiving PharmD curriculum, studies showed increasing integration of PrEP education into PharmD programs, providing data from all four regions of the U.S. [57]. No qualitative or longitudinal studies measured pharmacy student knowledge of or attitudes toward PrEP. However, in the included cross-sectional studies, significantly higher proportions of pharmacy students reported PrEP training compared to practicing pharmacists. This may explain the fact that pharmacists with fewer years of experience had a more comprehensive knowledge of PrEP and a higher intention to counsel. Additionally, because PharmD programs in the Northeast region have the most comprehensive PrEP education, this underscores the need to increase pharmacist PrEP training in other regions of the U.S., even in regions with a lower prevalence of HIV than the Northeast. PrEP training should be directly targeted toward more experienced pharmacists, as well as integrated into the core curriculum of pharmacy education; such new curricula may be piloted by practicing pharmacists.

Few studies investigated the implementation of PrEP interventions within pharmacies. Pharmacist-led PrEP programs that allow pharmacists to prescribe PrEP under a CPA show promise for PrEP initiation [70]. One of the included studies piloted a PrEP-focused curriculum led by pharmacists in California; however, no studies measured PrEP prescription by pharmacists in California, the first state in which autonomous pharmacist prescription of PrEP became legal [33]. Of the included intervention studies, most interventions opted for a program evaluation model, rather than a control group that would enable measurement of how much a pharmacy-based intervention might increase PrEP use. Greater comparison data are needed in future studies to assess change in PrEP use and adherence among post- and pre-intervention groups, especially those that include pharmacist screening of eligible individuals and prescriptive authority of PrEP. Methods like difference-in-difference analysis might be used to compare changes in PrEP usage pre- and post- California's policy intervention compared with other states. Recently passed legislation in Colorado and Oregon offer further opportunities for study [92–94].

Table 3 Recommendations for specific pharmacy-based PrEP interventions presented in commentaries and reviews

Author	Year published	Pharmacist training	Patient education	Pharmacist collaboration with providers	Policy changes to broaden pharmacist scope of practice	Pharmacist provision of HIV screening	Pharmacist prescription of PrEP	Pharmacy reimbursement/billing	Telehealth/Online pharmacies
Bruno et al.	2012		X			X			X
Ferrell et al.	2015		X	X					
Schafer et al.	2016	X		X	X	X			
Pinto et al.	2018	X	X		X		X	X	
Flash et al.	2018			X					
Mayer et al.	2018	X	X	X	X			X	
Adams et al.	2019			X					X
Farmer et al.	2019		X	X		X	X	X	
Hill et al.	2019		X	X		X			
Myers et al.	2019	X		X	X	X	X	X	
Sullivan et al.	2019			X			X		
McCree et al.	2020	X	X	X		X	X	X	X
Özdener-Poyraz et al.	2020	X	X	X	X	X	X		X
Lopez et al.	2020	X			X	X	X	X	
Wilby et al.	2020	X				X			
Mayer et al.	2020	X	X	X	X	X	X		X

Pharmacy-based PrEP programs should consider integrating a comprehensive sexual health program inclusive of routine HIV/STI testing. Diagnosis and treatment of STIs should be considered as part of a pharmacy-based PrEP program; however, scope of practice laws could impact what services might be included in these interventions.

Given the low trustworthiness in healthcare providers reported by Black and Latino MSM and its negative impact on PrEP uptake among these populations, having community pharmacists encourage PrEP use could be a more practical and approachable model that also reduces PrEP inequities [95, 96]. Thus, while many patients largely supported the idea of pharmacist prescription of PrEP, further studies are needed to assess attitudes of PrEP-eligible Black and Latinx MSM, who are disproportionately impacted by HIV infection within the U.S. The integration of pharmacists into the PrEP care continuum may increase the accessibility of PrEP among hard-to-reach populations that may be hesitant to use STI clinics or ask clinicians about PrEP. As such, the offer of HIV and STI testing by pharmacies is an immediate step that could be taken to generate demand and/or document the need for PrEP in a given pharmacy catchment area.

Structural and patient barriers to the incorporation of pharmacists into the PrEP continuum of care must be addressed prior to implementation. Structural barriers may include point-of-care testing for HIV diagnosis, suboptimal comfortability performing PrEP-related clinical activities, and issues with patient retention in PrEP care [44, 52, 69, 71]. Although community pharmacists are typically accessible to patients, difficulties in long-term retention still remain. Studies reporting clinics sites led by physicians measured that 57% and 30% of patients who initiated PrEP remain engaged in the PrEP continuum of care at 6 months and 12 months, respectively [19, 26]. Similar studies concerning pharmacist-led programs measured retention at 6 months and 12 months to be 61% and 28%, respectively [71]. Patient barriers may include confusion about insurance coverage and cost, privacy issues, as well as concerns about side effects of medication [60, 61, 68, 76].

There are limitations to this scoping review. Due to the nature of this scoping review, this study did not assess the quality of selected studies, but rather collected existing data and knowledge concerning pharmacy-based PrEP interventions [41, 42]. This review may not have included all studies related to the selected topic; studies of pharmacy-based claims were not included. Although pharmacy claims could provide metrics for PrEP persistence, we did not consider claims analyses in this scoping review. Studies conducted outside of the U.S., as well as any non-English literature, were also omitted due to the unique structure of the U.S. pharmacy system. Consequently, it is possible that other studies covered this topic but were not included in this scoping review. However, of sources extracted from the six major databases previously listed, we believe that the depth of our search provides a comprehensive assessment of data related to pharmacy-based PrEP interventions.

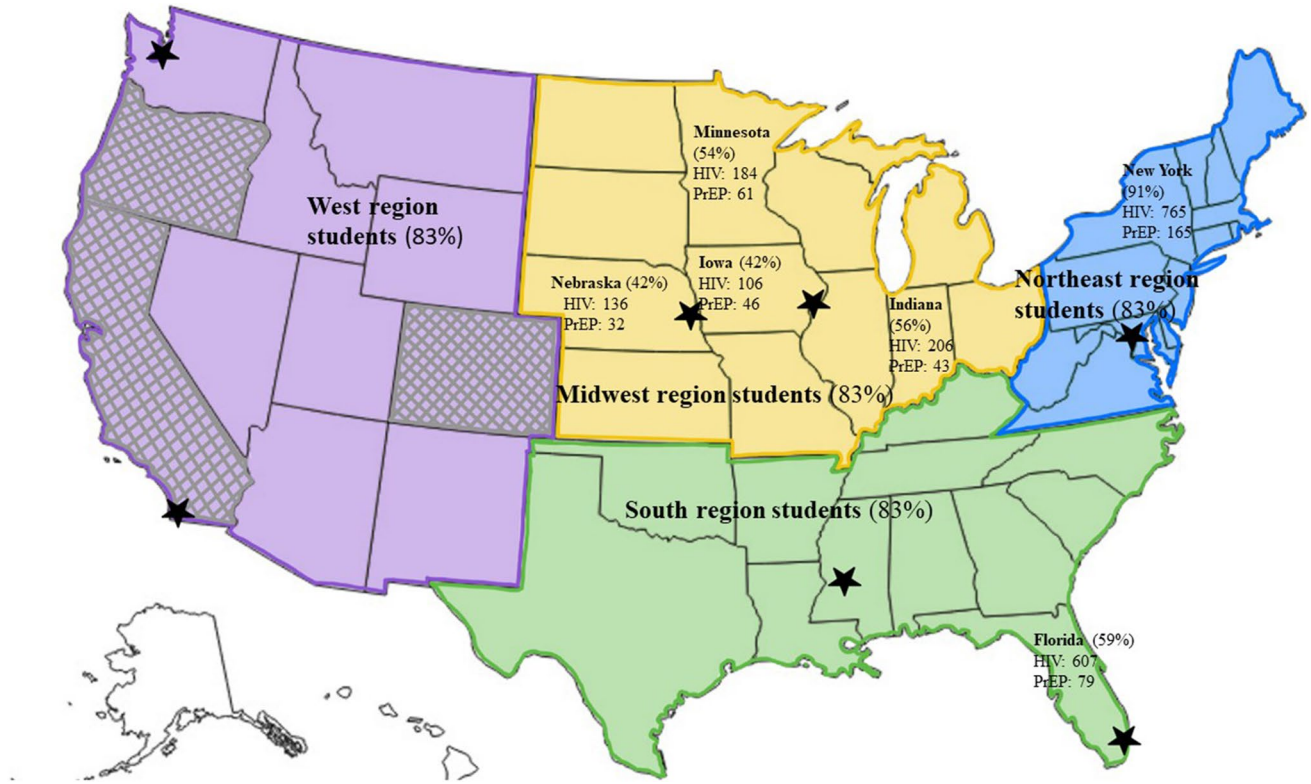

Fig. 2 Geographic visualization of PrEP knowledge among pharmacists in comparison to PrEP uptake and HIV prevalence in the U.S. State and regional percentages represent those of cohorts utilized in the included studies and do not necessarily reflect state-wide and region-wide data. Beneath represented state names are HIV cases per 100,000 residents of respective state and PrEP users per 100,000 residents of respective state (data from AIDSVu). Grid pattern represents states that have legalized pharmacist PrEP prescriptive authority as of June 2021. Stars represent areas in which pharmacist-led PrEP interventions have been piloted. Percentages listed for Nebraska and Iowa reflect a study in which the data from each state were not disaggregated

Conclusions

This scoping review provides evidence that an increasing number of studies are suggesting to expand the role of pharmacists in PrEP initiation and retention in care. High patient acceptance of pharmacy-based PrEP intervention is a strong foundation for the expansion of pharmacy-based PrEP interventions. However, the studies that implemented novel interventions lacked proper longitudinal data and comparison groups to adequately show the increased value of such programs. Pharmacy-based interventions focused on increased PrEP uptake should include control groups in order to assess the true effectiveness of these programs in comparison to pre-intervention individuals. They should also be geographically targeted to regions of the country that have populations at high risk for HIV and higher incidence of HIV infection, such as the U.S. Deep South, as well as regions in which pharmacists lack sufficient PrEP knowledge. Pharmacy-based telemedicine interventions may be useful, especially within communities that have difficulty attending appointments with providers, and in the COVID-19 era.

Effective pharmacy-based PrEP interventions require that pharmacists be properly trained on PrEP prescription and adherence [35, 78, 80, 87, 88, 91, 97]. Funding related to the EHE initiative through the CDC HIV Prevention Capacity Building Assistance Program now has specific modules to train pharmacists and pharmacy leadership to integrate expanded communicable diseases testing with provision of PrEP. Comprehensive training of pharmacists, particularly the more experienced, could heighten their willingness to participate in PrEP-related interventions, including screening and identification of eligible individuals. Moreover, adequate PrEP training among pharmacy staff could potentially increase patient comfortability with PrEP prescription and counseling by pharmacists [46, 89]. Following proper training, pharmacists could be integrated into PrEP clinics within community pharmacies through which they may conduct PrEP consultations and prescribe PrEP to eligible patients through CPAs. Patients should still be required to have a negative HIV test for continuing qualification for PrEP, which may be conducted by pharmacists, as well as meet all other CDC requirements for PrEP eligibility. Additionally, increased community education about PrEP may aid in the

adjustment of patients to care delivered by non-traditional providers. Subsequently, pharmacists could facilitate adherence counseling and monitoring through in-person visits and telemedicine.

These findings may help inform the development of pharmacy-based PrEP interventions, which we recommend should include practices such as collaborative agreements with physicians, prescriptive authority of pharmacists, and pharmacist and pharmacy student training on PrEP eligibility and adherence.

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Declarations

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