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Trends in the number and characteristics of HIV preexposure prophylaxis providers in the United States, 2014–2019

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Abstract

Background.—The number and characteristics of preexposure prophylaxis (PrEP) healthcare providers in the United States have not been reported.

Methods.—We analyzed a national pharmacy database that included >90% of all prescriptions dispensed by retail pharmacies and 60%–86% dispensed by mail order outlets. We estimated the number of PrEP providers by year, provider type, physician specialty, and geographic location. We also measured Gini coefficients for distribution of PrEP patients among providers.

Results.—The number of PrEP providers increased from 9,621 in 2014 to 65,822 in 2019. In 2019, 68.1% of PrEP providers were physicians. The proportion of nurse practitioners or physician assistants increased from 18.0% in 2014 to 29.7% in 2019. Among all U.S. healthcare providers, those who prescribed PrEP increased from 0.7% in 2014 to 4.3% in 2019. Among all general practice/family medicine physicians, percentage of who prescribed PrEP increased from 1.8% in 2014 to 13.6% in 2019, and from 14.2% to 34.2% among infectious disease physicians. The ratio of PrEP providers to 100 persons with PrEP indications was lowest in the South with 4.4. The Gini coefficient for distribution of PrEP patients among providers was 0.75 in 2019, with 50% of the PrEP patients prescribed PrEP by 2.2% of PrEP providers.

Conclusions.—An increasing number of providers prescribed PrEP during 2014–2019. The South had the largest number of new HIV diagnoses and greatest need for HIV prevention but had less PrEP service capacity compared with other regions. Expanded access to PrEP services is needed in the United States.

Keywords

HIV; preexposure prophylaxis (PrEP); healthcare provider

Introduction

Daily oral tenofovir-based preexposure prophylaxis (PrEP) is highly effective at reducing the risk of acquiring HIV infection. Clinical trials have demonstrated safety and efficacy

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of PrEP, with >90% reduction in the risk of sexual transmission among men who have sex with men (MSM) and heterosexual men and women, and >70% in the risk of transmission among people who inject drugs (PWID).[1–5] CDC recommends PrEP for adolescent and adult men and women with sexual and injection risk behaviors, including MSM, PWID, and heterosexual men and women at substantial risk of HIV acquisition.[3] In June 2019, PrEP received an A grade from the U.S. Preventive Services Task Force.[6] Expanding the use of PrEP is one of the key strategies to achieve the Ending the HIV Epidemic in the U.S. (EHE) initiative goal of reducing HIV infections by 90% or more in the United States by 2030.[7,8]

PrEP uptake in the United States has been increasing in recent years,[9–11] but most persons who can benefit from PrEP have not used it. CDC estimated that 1.2 million persons in the United States have clinical indications for PrEP, yet only 23% were prescribed PrEP in 2019.[10] Racial/ethnic disparities in PrEP use have been identified, with smaller percentages of persons prescribed PrEP in Black/African American and Hispanic/Latino populations that have the largest numbers of persons with PrEP indications.[10, 12] PrEP requires a prescription from an authorized healthcare provider, including physicians, physician assistants (PA) and nurse practitioners (NP). While providers' knowledge of and willingness to prescribe PrEP has increased, many are still unaware of or unfamiliar with PrEP for HIV prevention.[13] Other barriers might prevent a provider from prescribing PrEP, such as not having enough time, skill, or comfort to conduct an HIV risk assessment, concerns about its out-of-pocket medication cost, or that patients might have poor adherence.[14] PrEP remains an underutilized HIV prevention service, and many persons still lack access to PrEP.[15]

Understanding the capacity of the U.S. healthcare system to prescribe PrEP is critical to support expanded PrEP coverage and to inform interventions to increase access to PrEP services. The total number of U.S. PrEP prescribers has not been reported. A public database of PrEP providers, the National Prevention Information Network PrEP Provider Data and Locator Widget (https://npin.cdc.gov/preplocator), includes clinicians who reported they are currently providing PrEP clinical services and chose to be listed. This database serves as a resource for persons to locate a PrEP provider in their community.[16] However, this database does not include all PrEP prescribers, only those who were aware of this registry and chose to provide their information. The objective of this study was to estimate number of clinicians who have ever prescribed PrEP in the United States and to assess their characteristics and trends in prescribing practices from 2014 to 2019.

Methods

We analyzed IQVIA Real World Data – Longitudinal Prescriptions ("IQVIA data"), a commercial database with prescription and clinical information from pharmacy benefit managers, prescription processors, and health insurance companies. It included >90% of all prescriptions dispensed by retail pharmacies and 60%−86% dispensed by mail order outlets in the United States.[17] The database included information about PrEP prescriptions and patients, and healthcare providers who provided each PrEP prescription. We linked IQVIA provider data to the Centers for Medicaid and Medicare Services (CMS) National Plan and Provider Enumeration System (NPPES) that included variables for provider characteristics including sex and practice location.[18] We linked IQVIA provider data to the National

Uniform Claim Committee (NUCC) Health Care Provider Taxonomy Code Set to categorize healthcare provider types as physician, NP, or PA, and to assign physician specialty using the NUCC taxonomy codes.[19] Providers with a missing taxonomy record or a registered taxonomy that indicated they were not a physician, NP, or PA were grouped as unknown. We estimated the U.S. geographic and metropolitan or micropolitan statistical area locations where PrEP providers practiced by linking their 5-digit zip codes to Core-Based Statistical Areas in the U.S. Department of Housing and Urban Development ZIP-USPS crosswalk file.[20] We defined providers' rural or urban status by linking their 5-digit zip to codes in the CMS National Breakout of Geographic Area Definitions by Zip Code for Rural-Urban Commuting Area.[21] Both rural and super rural zip codes were coded as rural.

To estimate the number of providers who prescribed PrEP from 2014 to 2019, we identified all PrEP prescriptions in the IQVIA database using a previously developed and validated algorithm that discerned ARVs prescribed for PrEP, PEP, HIV treatment, and hepatitis B treatment.[9,11,22] Next, we identified providers who prescribed PrEP at least once during each year of our study period, and described their demographic characteristics, including sex, U.S. geographic region of practice, urban or rural location of practice, provider type, and physician specialty, by year. We categorized physician specialties of general practice/family medicine, internal medicine, preventive medicine, obstetrics and gynecology, and pediatrics as primary care specialties. We also estimated the number of PrEP providers by metropolitan statistical area (MSA) for each year during 2014–2019. To calculate the proportion of providers prescribing PrEP among all providers in the United States, we divided the number of PrEP prescribers by total number of registered physicians, NPs, and PAs in the CMS NPPES database. We used providers' dates of enumeration, deactivation and re-activation to approximate the number of active providers in each year.[18]

To understand the capacity of PrEP providers in U.S geographic regions and states, we calculated the number of PrEP providers per 100 persons with PrEP indications using published estimates of persons with PrEP indications.[12] We computed Gini coefficients and plotted Lorenz curves for cumulative distribution for each year from 2014 to 2019 as a measure of dispersion of PrEP patients among PrEP providers.[23] A Gini coefficient of 1 indicates a single provider served all PrEP patients, and a Gini coefficient of 0 indicates that all PrEP providers served equal numbers of patients. All analyses were performed using SAS version 9.4 (SAS Institute, Carey NC) and the DescTools package with R 4.0.2.[24]

Results

In 2019, we found that 65,822 providers prescribed PrEP for 279,054 patients, an increase from 9,621 providers who prescribed PrEP for 22,278 patients in 2014 (Table 1). The proportion of female providers increased from 37.6% in 2014 to 51.9% in 2019. In 2019, 31.2% of PrEP providers were in the South, followed by 27.5% in the West, 23.3% in the Northeast, and 17.8% in the Midwest. Most providers (92.6%) practiced in urban areas. The number and proportion of PrEP providers practicing in rural areas increased from 482 (5.0%) in 2014 to 4,836 (7.3%) in 2019.

The percentage of PrEP prescribers who were primary care providers (primary care physicians, NPs, or PAs) increased from 69.5% in 2014 to 87.1% in 2019. Among all providers who prescribed PrEP, NP and PA prescribers increased faster than physician prescribers. In 2014, 10.2% of the PrEP providers were NPs and 7.8% were PAs. By 2019, 20.8% of PrEP providers were NPs and 8.9% were PAs (Table 2). The percentage of PrEP providers who were physicians decreased from 79.8% in 2014 to 68.1% in 2019. In 2019, an NP prescribed PrEP for a mean of 6.4 patients and a PA for a mean of 5.2, compared to a physician who prescribed PrEP for a mean of 3.5 patients. Similarly, the number of general practice or internal medicine physicians who prescribed PrEP increased faster than infectious disease (ID) physicians who prescribed PrEP. Among physicians who prescribed PrEP, most were general practice/family medicine physicians (48.1%) or internal medicine physicians (29.5%). There were 1 362 ID physicians prescribed PrEP in 2014, accounted for 17.7% of the physician providers, and in 2019, ID physicians increased to 3 378, but the percentage decreased to 7.5% because of relatively more increase in other types of physicians.

Among all active U.S. healthcare providers in the NPPES data, the percentage who prescribed PrEP increased from 0.7% in 2014 to 4.3% in 2019. The increase can be attributed to the increased prescribing by nurse practitioners (from 0.5% in 2014 to 4.5% in 2019), physician assistants (from 0.7% to 4.1%), general practice/family medicine physicians (from 1.8% to 13.6%), internal medicine physicians (from 1.4% to 8.1%), and ID physicians (from 14.2% to 34.2%) (Table 3).

Figure 1 illustrates the growth in the number of PrEP providers in MSAs with >10 PrEP providers from 2014 to 2019. In 2019, the 10 MSAs with the largest number of PrEP providers were New York-Newark-Jersey City (n=5,870), Los Angeles-Long Beach-Anaheim (n=3,234), Chicago-Naperville-Elgin (n=2,269), Boston-Cambridge-Newton (n=2,192), Philadelphia-Camden-Wilmington (n=1,923), Washington DC-Arlington-Alexandria (n=1,893), San Francisco-Oakland-Hayward (n=1,763), Seattle-Tacoma-Bellevue (n=1,612), Miami-Fort Lauderdale-West Palm (n=1,458) and Dallas-Fort Worth-Arlington (n=1,240).

In 2019, the ratios of number of PrEP providers to persons with PrEP indications was highest in the Northeast, with 8.5 providers per 100 persons with PrEP indications, then 6.2 per 100 in the West, 5.7 per 100 in the Midwest, and lowest in the South, with 4.4 per 100. The 10 states with highest ratio of PrEP providers per persons with PrEP indications were Massachusetts (13.0 providers per 100 persons with indications), New Hampshire (11.5), Iowa (11.3), Nebraska (11.0), Kansas (10.6), Maine (9.7), Connecticut (9.3), West Virginia (8.8), Utah (8.7), and New York (8.3) (Appendix Table 1 http://links.lww.com/QAI/B700).

PrEP patients were not evenly distributed among PrEP providers. On average, each prescriber had 4.2 patients (median = 1, interquartile range of 1–3). In 2019, 55.3% of providers had only one PrEP patient; whereas the leading prescriber served 3,245 patients. We found that the average number of patients prescribed PrEP by the top 5% PrEP providers increased from 22 in 2014 to 52 in 2019, while average number of patients prescribed PrEP by the remaining 95% of PrEP providers remained less than 5 patients (Appendix Table 2

http://links.lww.com/QAI/B700). Lorenz curves and Gini coefficients demonstrated that in 2019, 50% of the PrEP patients were prescribed PrEP by 2.2% of the PrEP providers. The Gini coefficient of the cumulative number of PrEP patients to the cumulative number of PrEP providers increased from 0.59 in 2014 to 0.75 in 2019 (Figure 2). The increase of Gini coefficient indicates that during 2014 to 2019 a smaller portion of PrEP providers served an increasingly larger portion of PrEP patients.

Discussions

The number of PrEP providers in the United States increased from 9,621 in 2014 to 65,822 in 2019, representing an increase of 0.7% of all U.S. healthcare providers in 2014 to 4.3% in 2019. This trend is parallel to the increases in the number of PrEP users, which increased from 13,748 in 2014 to 284,464 in 2019.[9,10]. Among all PrEP providers, the proportion who were primary care providers increased over the study period. The increased number of providers, especially primary care physicians, NPs and PAs, provides a strong foundation to increase PrEP capacity in the United States. While a small proportion of PrEP providers prescribed most PrEP, the large number of providers who ever prescribed PrEP indicates that these providers are prepared to provide PrEP services with the support of provider education, tools, and system-level interventions to identify patients with PrEP indications and prescribe PrEP.

Most PrEP providers were physicians. About a third of ID physicians have ever prescribed PrEP, the highest percentage of any clinical specialty (Table 3). ID physicians were likely more aware of PrEP as an HIV prevention option than other types of physicians and were probably more comfortable and experienced prescribing antiretroviral medications.[26] ID physicians also might encounter more patients with PrEP indications than other types of physicians, such as persons with sexually transmitted infections or who have a partner(s) with HIV. Yet, PrEP is a preventive healthcare service that should be easily and safely delivered by primary care providers. It is encouraging that the proportion of primary care providers who prescribed PrEP increased from 2014 to 2019. We found that NPs and PAs had higher average numbers of PrEP patients compared to physicians. NPs and PAs providers can play an important role in increasing the use of PrEP to help accomplish the goals of the EHE initiative. Studies have found that midlevel providers provide quality patient care on par with physicians, and often adhere better to clinical practice guidelines than physicians.[27, 28] They can serve as physician extenders in communities and areas with underserved populations.[29] These attributes make them good candidates for education about PrEP and tools to support increased PrEP assessments and prescribing.

PrEP providers were not proportionately distributed in U.S. geographic regions with the greatest need for PrEP, similar to findings in another study.[15] We found that less than a third of PrEP providers practiced in the South despite this region having the largest proportion of persons (52.4%) with an HIV diagnosis in 2019 (52.0%),[30] and the largest proportion of persons with PrEP indications (40.8%).[12] More than 92% of PrEP providers practiced in urban areas, and were concentrated in large metropolitan areas such as New York, Los Angeles, and Chicago. Only about 8% PrEP providers practiced in rural areas in 2019. The small number of rural PrEP providers presents challenges to provide PrEP to persons in

these communities. The EHE initiative will support seven states with high numbers of HIV diagnosis in rural areas to increase HIV testing, PrEP services, HIV care services, and other HIV prevention services.[8]

We found that 2.2% of PrEP providers cared for about half of all PrEP patients in 2019, and the Gini coefficient of patient distribution among providers was 0.75. Furthermore, we observed that the Gini coefficients of PrEP patient distribution increased from 2014 to 2018, indicating that patient volume of a small proportion of PrEP providers increased faster than that of most PrEP providers, and that most new PrEP users were served by these leading providers (Figure 2 and Appendix Table 2 http://links.lww.com/QAI/B700). Over the 5-year period of our study it seems that PrEP "centers of excellence" have emerged, with a small number of providers having the highest volume of PrEP patients and thus the most experience prescribing PrEP. Centers of excellence have been demonstrated to have better outcomes and less morbidity and mortality for some health services, such as complex surgical procedures and cardiovascular procedures.[31–33] Some advantages exist for communities to have a large PrEP clinic where persons can seek care. However, in 2018, 82% of persons with PrEP indications did not use PrEP for many reasons such as a lack of access to these providers or being unaware of PrEP. Therefore, the increasing number of primary care providers who ever prescribed PrEP can be supported to increase PrEP use in their patient populations as a common preventive service similar to prescribing an antihypertensive medication or providing a vaccination.

Our study has four limitations. First, the IQVIA data did not include PrEP providers and prescriptions for all U.S. PrEP users, such as those in Veterans Affairs health clinics. This likely resulted in an underestimate of the number of PrEP providers and prescriptions. Second, PrEP prescriptions were identified using an algorithm that had high sensitivity and specificity to identify a PrEP prescription,[22] yet might exclude a very small number of PrEP prescriptions resulting in an underestimate of PrEP prescriptions. Also, prescriptions for ARV treatment of persons with incomplete clinical information in the IQVIA database might be misclassified as PrEP, resulting in an overestimate of the number of PrEP providers and prescriptions. Third, it is possible that specialist physicians provided some primary care services and prescribed PrEP, resulting in an underestimate of the proportion of U.S. primary care providers. Fourth, it is possible that some providers enumerated in the CMS NPPES database were not actively providing clinical care, resulting in an underestimate of the proportion of providers who prescribed PrEP.

Our study revealed steady growth in healthcare workforce that prescribes PrEP in the United States, and indicated the large clinical capacity for PrEP services. But distribution of the PrEP providers is not proportionate to the distribution of persons who need PrEP. Interventions are needed to support the expansion of PrEP services that are appropriate for the diverse community healthcare resources and HIV prevention needs of the population. In areas with too few PrEP providers to serve the needs of the community, implementation studies are needed to understand best practices to increase PrEP capacity. Education of healthcare providers can increase their PrEP awareness; and implementation of support tools, including the use of clinical decision support tools,[34,35] can increase screening of patients for PrEP indications and prescribing PrEP. These interventions can support and

enhance the existing capacity to provide access to quality PrEP services for all who need PrEP. To achieve the goals of EHE, the U.S. will need more equally distributed PrEP services as well as increasing number of PrEP providers.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Conflicts of Interest and Sources of Funding:

All authors have completed and submitted the International Committee of Medical Journal Editors form for disclosure of potential conflicts of interest. No potential conflicts of interest were disclosed. This work is supported by the Centers for Disease Control and Prevention, with no external funding.

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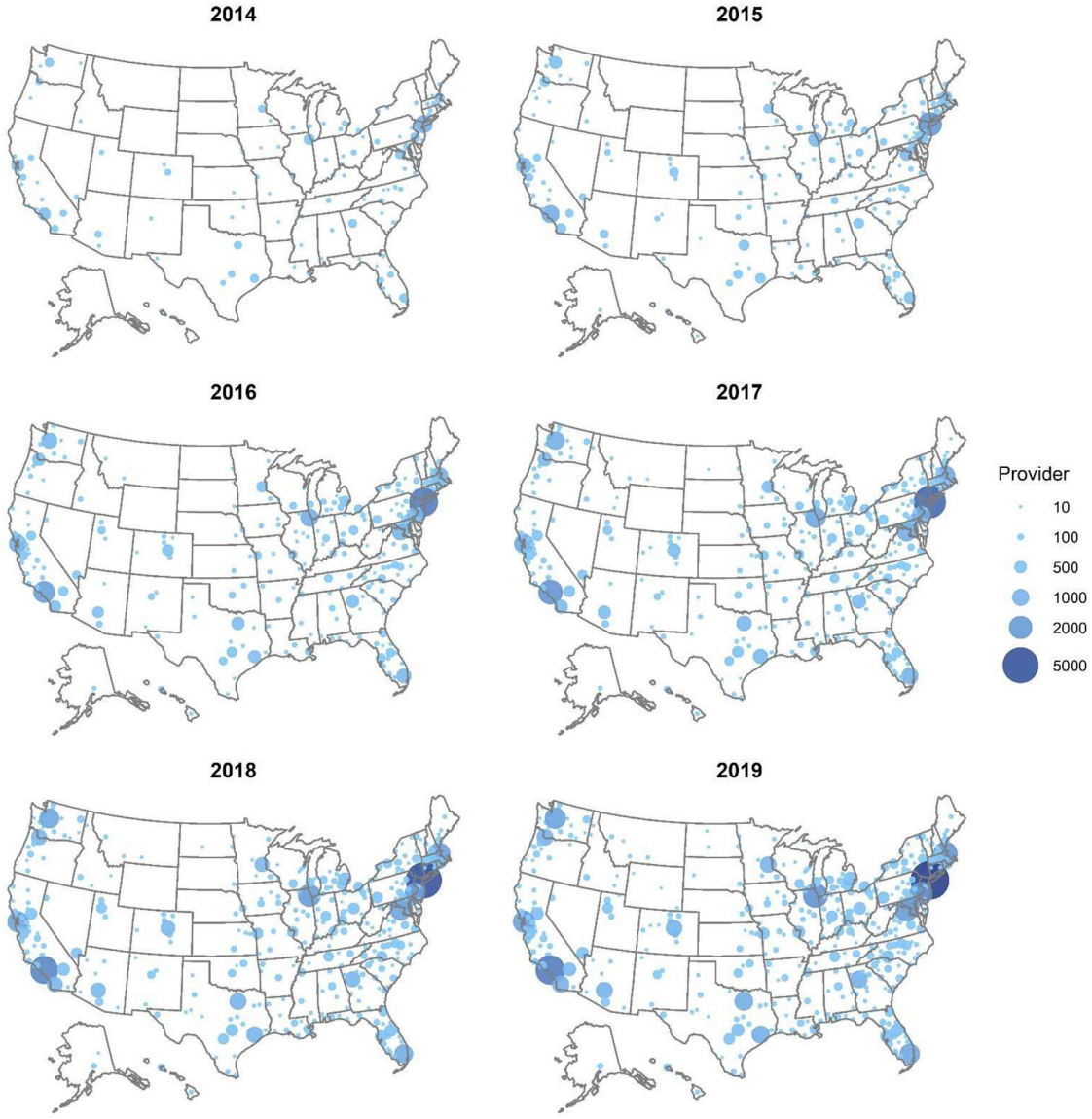

Figure 1.

Number of HIV preexposure prophylaxis providers in the Metropolitan Statistical Areas — United States, 2014–2019

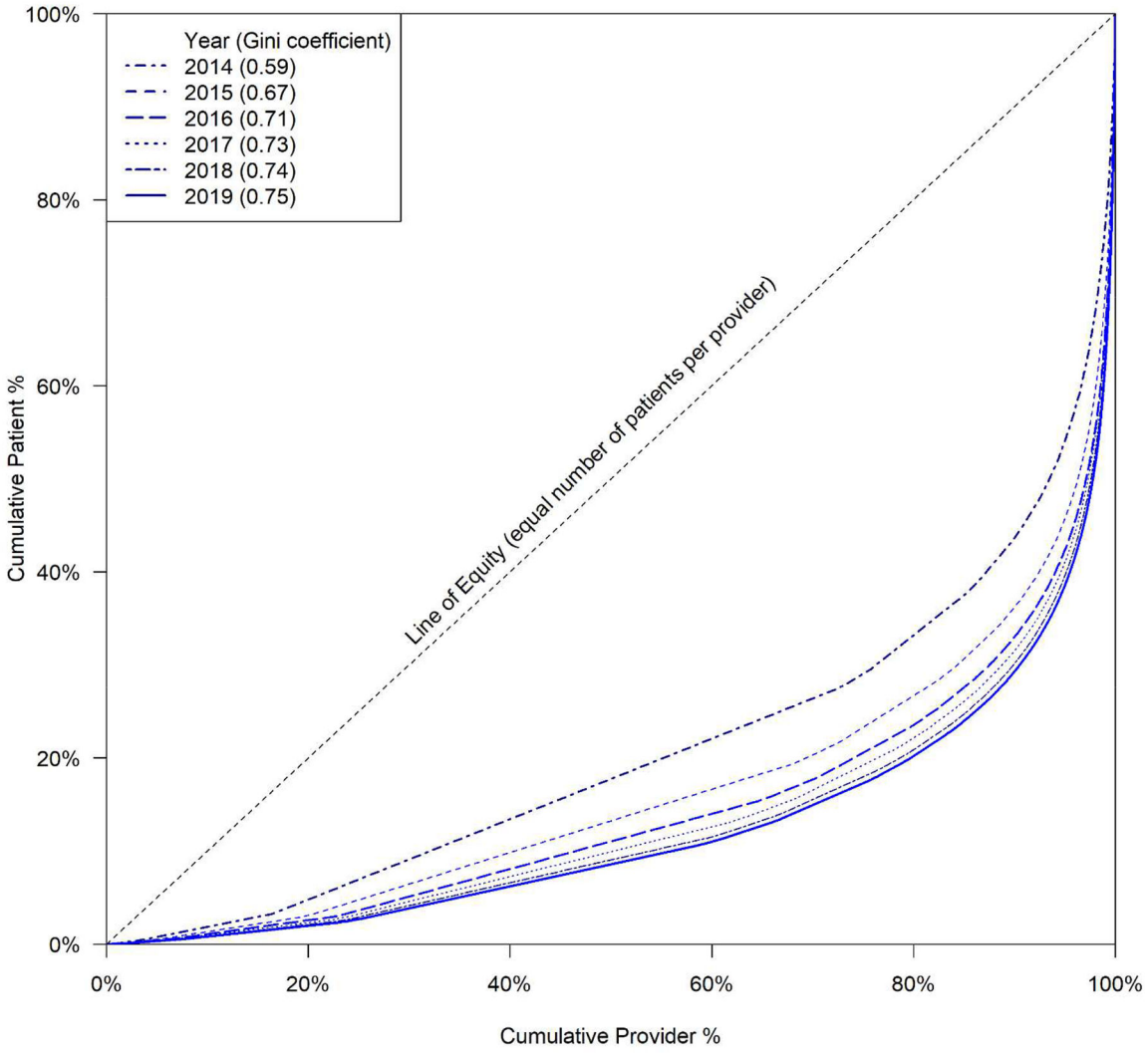

Figure 2.

Lorenz curves and Gini coefficients of cumulative HIV preexposure prophylaxis patient distribution over cumulative PrEP providers — United States, 2014–2019

* A Gini coefficient of 0 means all PrEP providers served equal number of patients and is represented by the diagonal line; a Gini coefficient of 1 means a single provider served all PrEP patients.

** The increasing trend in Gini coefficient from 2014 to 2019 suggests that, over time, a smaller portion of PrEP providers are serving an increasingly larger portion of PrEP patients. In 2019, 2.2% of PrEP providers served 50.0% of all PrEP patients.

Table 1.

HIV preexposure prophylaxis providers by sex, region, and urban or rural location — United States, 2014–2019

	2014	2015		2016		2017		2018		2019	
	N (%)	N (%)	Annual Change (%)	N (%)	Annual Change (%)	N (%)	Annual Change (%)	N (%)	Annual Change (%)	N (%)	Annual Change (%)
Total	9 621 (100.0)	18 970 (100.0)	97.2	31 470 (100.0)	65.9	41 927 (100.0)	33.2	54 356 (100.0)	29.6	65 822 (100.0)	21.1
Sex											
Male	5 850 (60.8)	11 067 (58.3)	89.2	17 213 (54.7)	55.5	21 714 (51.8)	26.1	26 794 (49.3)	23.4	30 992 (47.1)	15.7
Female	3 618 (37.6)	7 626 (40.2)	110.8	13 669 (43.4)	79.2	19 521 (46.6)	42.8	26 848 (49.4)	37.5	34 150 (51.9)	27.2
Unknown	153 (1.6)	277 (1.5)	81.0	588 (1.9)	112.3	692 (1.7)	17.7	714 (1.3)	3.2	680 (1.0)	−4.8
U.S. geographic region											
Northeast	2 346 (24.4)	4 622 (24.4)	97.0	7 612 (24.2)	64.7	9 977 (23.8)	31.1	12 853 (23.6)	28.8	15 350 (23.3)	19.4
Midwest	1 444 (15.0)	2 950 (15.6)	104.3	5 172 (16.4)	75.3	7 141 (17.0)	38.1	9 373 (17.2)	31.3	11 736 (17.8)	25.2
South	2 952 (30.7)	5 615 (29.6)	90.2	9 411 (29.9)	67.6	12 703 (30.3)	35.0	16 718 (30.8)	31.6	20 504 (31.2)	22.6
West	2 821 (29.3)	5 728 (30.2)	103.0	9 196 (29.2)	60.5	12 015 (28.7)	30.7	15 306 (28.2)	27.4	18 093 (27.5)	18.2
Unknown	58 (0.6)	55 (0.3)	−5.2	79 (0.3)	43.6	91 (0.2)	15.2	106 (0.2)	16.5	139 (0.2)	31.1
Urban or rural location *											
Urban	9 131 (94.9)	17 934 (94.5)	96.4	29 462 (93.6)	64.3	39 066 (93.2)	32.6	50 467 (92.8)	29.2	60 944 (92.6)	20.8
Rural	482 (5.0)	1 023 (5.4)	112.2	1 990 (6.3)	94.5	2 827 (6.7)	42.1	3 853 (7.1)	36.3	4 836 (7.3)	25.5
Unknown	8 (0.1)	13 (0.1)	62.5	18 (0.1)	38.5	34 (0.1)	88.9	36 (0.1)	5.9	42 (0.1)	16.7

* An urban location was based on the 2019 Centers for Medicare & Medicaid Services zipcode-to-carrier locality file for urban or rural locations.

Table 2.

HIV preexposure prophylaxis providers by provider type and physician specialty — United States, 2014–2019

	2014	2015		2016		2017		2018		2019	
	N (%)	N (%)	Annual Change (%)	N (%)	Annual Change (%)	N (%)	Annual Change (%)	N (%)	Annual Change (%)	N (%)	Annual Change (%)
Total	9 621 (100.0)	18 970 (100.0)	97.2	31 470 (100.0)	65.9	41 927 (100.0)	33.2	54 356 (100.0)	29.6	65 822 (100.0)	21.1
Provider type											
Physician	7 678 (79.8)	14 946 (78.8)	94.7	23 789 (75.6)	59.2	30 539 (72.8)	28.4	38 207 (70.3)	25.1	44 800 (68.1)	17.3
Nurse Practitioner	984 (10.2)	2 204 (11.6)	124.0	4 293 (13.6)	94.8	6 730 (16.1)	56.8	10 180 (18.7)	51.3	13 723 (20.8)	34.8
Physician Assistant	750 (7.8)	1 419 (7.5)	89.2	2 591 (8.2)	82.6	3 674 (8.8)	41.8	4 809 (8.8)	30.9	5 877 (8.9)	22.2
Unknown type	209 (2.2)	401 (2.1)	91.9	797 (2.5)	98.8	984 (2.3)	23.5	1 160 (2.1)	17.9	1 422 (2.2)	22.6
Physicians: Primary care specialty											
General practice / family medicine	2 529 (32.9)	5 919 (39.6)	134.0	10 190 (42.8)	72.2	13 727 (44.9)	34.7	17 876 (46.8)	30.2	21 564 (48.1)	20.6
Internal medicine	2 074 (27.0)	4 279 (28.6)	106.3	6 857 (28.8)	60.2	8 846 (29.0)	29.0	11 188 (29.3)	26.5	13 230 (29.5)	18.3
Preventive medicine	59 (0.8)	82 (0.5)	39.0	125 (0.5)	52.4	160 (0.5)	28.0	185 (0.5)	15.6	219 (0.5)	18.4
Obstetrics and gynecology	98 (1.3)	176 (1.2)	79.6	284 (1.2)	61.4	400 (1.3)	40.8	599 (1.6)	49.8	763 (1.7)	27.4
Pediatrics	196 (2.6)	475 (3.2)	142.3	812 (3.4)	70.9	1 142 (3.7)	40.6	1 496 (3.9)	31.0	1 925 (4.3)	28.7
Physicians: Non-primary care specialty											
Infectious disease	1 362 (17.7)	2 089 (14.0)	53.4	2 812 (11.8)	34.6	3 102 (10.2)	10.3	3 264 (8.5)	5.2	3 378 (7.5)	3.5
Emergency medicine	579 (7.5)	726 (4.9)	25.4	1 003 (4.2)	38.2	1 128 (3.7)	12.5	1 413 (3.7)	25.3	1 466 (3.3)	3.8
Other	781 (10.2)	1 200 (8.0)	53.6	1 706 (7.2)	42.2	2 034 (6.7)	19.2	2 186 (5.7)	7.5	2 255 (5.0)	3.2

Table 3.

Percentage of HIV preexposure prophylaxis providers among healthcare providers by provider type and specialty — United States, 2014–2019

	2014		2015		2016		2017		2018		2019	
	Total providers N	**PrEP providers N (%)**	**Total providers N**	**PrEP providers N (%)**	**Total providers N**	**PrEP providers N (%)**	**Total providers N**	**PrEP providers N (%)**	**Total providers N**	**PrEP providers N (%)**	**Total providers N**	**PrEP providers N (%)**
Total	1 260 751	9 412 (0.7)	1 315 466	18 569 (1.4)	1 368 765	30 673 (2.2)	1 418 971	40 943 (2.9)	1 466 423	53 196 (3.6)	1 514 967	64 400 (4.3)
Physicians by specialty												
Infectious Disease	9 558	1 362 (14.2)	9 706	2 089 (21.5)	9 781	2 812 (28.7)	9 819	3 102 (31.6)	9 848	3 264 (33.1)	9 866	3 378 (34.2)
General Practice / Family Medicine	140 294	2 529 (1.8)	144 794	5 919 (4.1)	149 007	10 190 (6.8)	152 882	13 727 (9.0)	155 570	17 876 (11.5)	158 101	21 564 (13.6)
Internal Medicine	144 186	2 074 (1.4)	149 912	4 279 (2.9)	155 310	6 857 (4.4)	159 720	8 846 (5.5)	162 138	11 188 (6.9)	164 245	13 230 (8.1)
Preventive Medicine	7 399	59 (0.8)	7 521	82 (1.1)	7 612	125 (1.6)	7 699	160 (2.1)	7 752	185 (2.4)	7 830	219 (2.8)
Obstetrics and Gynecology	49 985	98 (0.2)	51 171	176 (0.3)	52 162	284 (0.5)	52 576	400 (0.8)	53 018	599 (1.1)	53 471	763 (1.4)
Pediatrics	95 373	196 (0.2)	97 880	475 (0.5)	100 139	812 (0.8)	102 080	1 142 (1.1)	103 207	1 496 (1.4)	104 226	1 925 (1.8)
Emergency Medicine	58 162	579 (1.0)	60 357	726 (1.2)	62 458	1 003 (1.6)	64 126	1 128 (1.8)	64 969	1 413 (2.2)	65 612	1 466 (2.2)
Other	469 870	781 (0.2)	478 999	1 200 (0.3)	485 355	1 706 (0.4)	490 432	2 034 (0.4)	494 921	2 186 (0.4)	499 177	2 255 (0.5)
Nurse Practitioner and Physician Assistant												
Nurse practitioner	183 201	984 (0.5)	204 484	2 204 (1.1)	228 178	4 293 (1.9)	252 693	6 730 (2.7)	279 205	10 180 (3.6)	307 625	13 723 (4.5)
Physician assistant	102 723	750 (0.7)	110 642	1 419 (1.3)	118 763	2 591 (2.2)	126 944	3 674 (2.9)	135 795	4 809 (3.5)	144 814	5 877 (4.1)

*Number of total providers is estimated from the Centers for Medicare & Medicaid Services (CMS) has developed the National Plan and Provider Enumeration System (NPPES), Jan 2020. (URL: https://nppes.cms.hhs.gov/#/). For each year, only activated providers are counted as the denominators. We inferred the status of active provider each year using providers' dates of enumeration, deactivation, and reactivation in the NPPES data.

**Provider's type and specialty is defined by the National Uniform Claim Committee (NUCC) Health Care Provider Taxonomy Code Set. (URL: https://www.nucc.org/index.php/code-sets-mainmenu-41/provider-taxonomy-mainmenu-40)