Impact of COVID-19 on HIV Preexposure Prophylaxis Prescriptions in the United States – A Time Series Analysis

Ya-Lin A. Huang, PhD[1], Weiming Zhu MD, PhD[1], Jeffrey Wiener, PhD[1], Athena P. Kourtis, MD, PhD[1], H. Irene Hall, PhD[1], Karen W. Hoover, MD[1]

[1]Division of HIV Prevention, National Center for HIV/AIDS, Viral Hepatitis, STD, and TB Prevention, CDC, Atlanta, Georgia, USA.

Correspondence: Ya-Lin A Huang, PhD, MS. 1600 Clifton Road NE Mailstop US8-4, Atlanta, Georgia 30329, United States. Email: yhuang@cdc.gov

Summary: This study assessed the impact of the COVID-19 pandemic on PrEP prescriptions in the United States from March 2020 through March 2021 and found a 22% reduction in PrEP prescriptions and a 25% reduction in number of new PrEP users.

Abstract

Background: Uptake of HIV preexposure prophylaxis (PrEP) has been increasing in the United States since its FDA approval in 2012; however, the COVID-19 pandemic may have affected this trend. Our objective was to assess the impact of the COVID-19 pandemic on PrEP prescriptions in the United States.

Methods: We analyzed data from a national pharmacy database from January 2017 through March 2021 to fit an interrupted time-series model that predicted PrEP prescriptions and new PrEP users had the pandemic not occurred. Observed PrEP prescriptions and new users were compared with those predicted by the model. Main outcomes were weekly numbers of PrEP prescriptions and new PrEP users based on a previously developed algorithm. The impact of the COVID-19 pandemic was quantified by computing rate ratios and percent decreases between the observed and predicted counts during 3/15/2020 – 3/31/2021.

Results: In the absence of the pandemic, our model predicted that there would have been 1,058,162 PrEP prescriptions during 3/15/2020 – 3/31/2021. We observed 825,239 PrEP prescriptions, a 22.0% reduction (95% CI: 19.1%-24.8%) after the emergency declaration. The model predicted 167,720 new PrEP users during the same period; we observed 125,793 new PrEP users, a 25.0% reduction (95% CI: 20.9%-28.9%). The COVID-19 impact was greater among younger persons and those with commercial insurance. The impact of the pandemic varied markedly across states.

Conclusion: The COVID-19 pandemic disrupted an increasing trend in PrEP prescriptions in the United States, highlighting the need for innovative interventions to maintain access to HIV prevention services during similar emergencies.

Keywords: PrEP, preexposure prophylaxis, COVID-19

BACKGROUND

On March 13, 2020, the President of the United States declared a national emergency in response to the outbreak of coronavirus disease 2019 (COVID-19) in the United States caused by the novel severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) [1]. Many states and localities issued mandatory "stay-at-home" or "shelter-in-place" orders and other protective measures in an effort to reduce the spread of SARS-CoV-2 [2-4]. The Centers for Disease Control and Prevention (CDC) also recommended individuals and groups practice social distancing to reduce exposure to SARS-CoV-2 [5]. These policies, as well as individuals' fear of COVID-19 exposure, resulted in decreased use of health services, especially preventive and elective health care [6, 7].

HIV preexposure prophylaxis (PrEP) with daily oral antiretroviral medications is a safe and effective intervention that reduces the risk of HIV acquisition among men who have sex with men (MSM), heterosexual men and women, and persons who inject drugs [8, 9]. In 2012, the U.S. Food and Drug Administration (FDA) approved tenofovir disoproxil fumarate combined with emtricitabine (FTC/TDF) as PrEP [10]. The CDC published clinical PrEP practice guidelines in 2014 and updated guidelines in 2017 and in 2021 [11-13]. Nondaily event-driven PrEP (also called "2-1-1" PrEP), while not an FDA-approved regimen, has been prescribed and used among selected patients, as two clinical trials have demonstrated its HIV prevention efficacy among MSM [13]. The number of persons prescribed PrEP had been increasing since its approval. Compared with the estimated 1.1 million persons with indications for PrEP in the United States, approximately 280,000 (23%) were prescribed PrEP in 2019 [14]. In October 2019, the FDA approved a second drug for PrEP – tenofovir alafenamide combined with emtricitabine (FTC/TAF) [15]. About one third of existing PrEP users switched to the newer formulation within 12 months of its approval [16]. Several generic formulations of FTC/TDF were also approved by FDA in the fall of 2020.

In the absence of the COVID-19 pandemic, the trend in national PrEP prescriptions was expected to

continue to increase. However, when shelter-in-place and social distancing orders were issued, many healthcare providers temporarily closed their practice, limited it to providing urgent care, or provided telemedicine services [17, 18]. The COVID-related closures as well as individuals' concerns about potential exposure to SARS CoV-2 likely affected the use of PrEP services. Persons who choose to initiate PrEP need to be assessed by a clinician for existing HIV, sexually transmitted infections (STIs), hepatitis B, hepatitis C, and their renal function. Persons who have been taking PrEP are recommended to have monitoring health care visits every 3 months for assessment of ongoing risk of HIV acquisition, PrEP adherence and persistence counseling, and laboratory testing for HIV, STIs, and renal function [12]. The pandemic also likely affected adherence to these recommended clinical guidelines. The objective of this study was to quantify the impact of the COVID-19 pandemic on PrEP prescriptions and new PrEP users in the United States by analyzing a national pharmacy database.

METHODS

Data Source

We analyzed data from the IQVIA Real World Data—Longitudinal Prescriptions Database (hereafter, IQVIA database) from January 2017 to March 2021. The IQVIA database captures prescriptions from all payers and represents approximately 92% of all prescriptions dispensed from retail pharmacies and 60-86% from mail order outlets in the United States [19]. The database does not include prescriptions from closed healthcare systems such as health maintenance organizations or the Veterans Administration. Prescriptions in the IQVIA database are linked to medical claims to identify associated diagnoses, and to the Experian consumer database to identify patient demographic characteristics. Race/ethnicity data were available for <40% of persons prescribed PrEP.

Measures

We identified PrEP prescriptions in the IQVIA database from January 1, 2017 to March 31, 2021 using a previously developed and validated algorithm [20-22]. We Identified all FTC/TDF, FTC/TAF (included since 2019), and generic FTC/TDF (included since October 2020) prescriptions among

persons aged ≥16 years in the database and excluded prescriptions for HIV treatment, hepatitis B treatment, or HIV post-exposure prophylaxis using coexisting diagnosis codes or other prescribed antiretroviral drugs indicating non-PrEP uses. The remaining prescriptions not excluded by the algorithm were defined as PrEP prescriptions.

We defined two outcome measures in this study and analyzed separately: (1) the number of PrEP prescriptions and (2) the number of new PrEP users. We estimated the weekly cumulative numbers of prescriptions and new users throughout the study period. To estimate the number of PrEP prescriptions, we captured non-refilled PrEP prescriptions provided by a prescriber for new or ongoing users. In other words, we included new or renewed PrEP prescriptions and did not count refilled prescriptions. We then aggregated all PrEP prescriptions at the person-level and identified new PrEP users each week if that user had no prior PrEP prescriptions in the IQVIA database.

The outcome measures were reported by patient sex, age group, geographic region, payer type, and race/ethnicity. Payer type at the person-level was calculated based on a hierarchical variable, constructed using a payer hierarchy of public insurance (Medicaid/CHIP and Medicare), commercial insurance, cash, and other. The other payer type category included coupon/voucher programs, discount card programs, and state or manufacturer medication assistance programs (MAPs). We also stratified the outcomes by state. A state was identified using 3-digit ZIP codes of patients' residential location in the IQVIA database.

Analysis

Weekly PrEP prescription data before and after the start of the COVID-19 pandemic were modeled as an interrupted time series using a generalized linear quasi-Poisson model adjusted for seasonality. This approach models the sequence of repeated weekly observations which is interrupted by an event, in this case the start of the COVID-19 pandemic, occurring at a known timepoint. The impact

of the COVID-19 pandemic interruption can be evaluated by comparing the expected trend had the interruption not taken place against the observed change in the time period after the interruption. The time series model was used to predict the number of PrEP prescriptions and new PrEP users for the period of March 15, 2020 through March 31, 2021, assuming the COVID-19 pandemic did not occur. The impact of COVID-19 was measured by comparing predicted PrEP prescriptions and observed PrEP prescription counts during March 15, 2020 – March 31, 2021 using rate ratios and the percent reduction with 95% confidence intervals (CIs). The estimated effect of COVID-19 was also stratified by patient demographic characteristics and by state. All analyses were performed using R version 3.6.1 (R Foundation for Statistical Computing, Vienna, Austria).

RESULTS

National Trends

The observed weekly number of PrEP prescriptions and modeled trends from 2017-2021 are shown in Figures 1a and 2a. The trend steadily increased from January 2017 until March 14, 2020. The interrupted time series model predicted that there would have been 1,058,162 PrEP prescriptions during March 15, 2020 to March 31, 2021 in the absence of the pandemic. We observed 825,239 PrEP prescriptions in the IQVIA database during the same time period. The rate ratio for the observed and predicted trends was 0.78, indicating a 22.0% reduction (95% CI: 19.1%-24.8%) during that period. Similarly, the observed weekly number of new PrEP users increased from January 2017 until March 14, 2020 (Figures 1b and 2b). The model predicted 167,720 new PrEP users during the evaluation period, and we observed 125,793 new PrEP users in the IQVIA database, a rate ratio of 0.75, indicating a 25.0% reduction (95% CI: 20.9%-28.9%) after the emergency declaration (Table 1).

The observed and expected numbers and percent decreases are broken down by month (Table 1). The monthly percent reduction in the number of PrEP prescriptions was mostly around 20% throughout the observation period, compared to the expected number. We observed a 17.4%

reduction in the number of PrEP prescriptions in June 2020, and decreases greater than 25% in December 2020, and February and March 2021. We observed a 39.5% and 34.2% reduction in the number of new PrEP users in April and May 2020, compared to the expected number of new PrEP users. New PrEP users rebounded in June 2020 with only a 16.5% reduction, then we observed wider gaps until October 2020. In December 2020, we observed a 30.9% reduction in the number of new PrEP users, but after then the gaps were around 20%.

Trends by Demographic characteristics

When stratified by demographic characteristics, the percent reduction in PrEP prescriptions and PrEP users did not vary substantially between men and women or by race/ethnicity during the COVID-19 pandemic (Table 2). We observed larger decreases in new PrEP users for persons aged 16-29 years (27.6% reduction (95% CI, 22.6%-32.2%), compared with persons aged >50 years (18.5% reduction (95% CI, 13.7%-23.1%). Both the number of PrEP prescriptions and new PrEP users in the South decreased to a lesser extent [17.4% reduction (95% CI, 14.1%-20.6%) in PrEP prescriptions; 14.4 reduction (95% CI, 9.5%-19.1%) in new PrEP users] than in other regions.

When we stratified by payer type, larger reductions in PrEP prescriptions were observed for persons who had commercial insurance (23.5% reduction (95% CI, 20.7%-26.3%)) compared with persons with public health insurance (15.0% reduction (95% CI, 11.5%-18.4%)) and persons who paid with cash (12.7% reduction (95% CI, 6.8%-18.3%)). Among new PrEP users, greater decreases were found among those who paid with other type of payer (10.7% reduction (95% CI, 5.0%-16.1%)) compared with persons with commercial insurance (29.1% reduction (95% CI, 25.0%-33.1%)), public insurance (28.2% reduction (95% CI, 23.5%-32.6%)), or those who paid with cash (22.3% reduction (95% CI, 15.8%-28.3%)).

Trends by State

The COVID-19 impact on the number of PrEP prescriptions varied markedly among states, ranging from a 9.9% increase (95% CI, -20.3%- -0.4%) in Delaware to a 84.1% reduction (95% CI, 77.4%-88.8%) in South Dakota. The impact on the number of new PrEP users ranged from a 26.4% increase (95% CI, -57.1%- -1.7%) in Delaware to a 61.8% reduction (95% CI, 44.9%-73.4%) in South Dakota, although confidence intervals were frequently wide in states with low numbers of PrEP prescriptions before the pandemic. In states with the largest number of PrEP prescriptions prior to the pandemic, such as California, Georgia, Illinois, Massachusetts, and New York, reductions of >35% were observed in new PrEP users after the emergency declaration. In some states, such as Delaware, Florida, Nebraska, and Oklahoma, smaller reductions were observed in PrEP prescriptions and new PrEP users after the emergency declaration (Table 3).

DISCUSSION

We found a 22% decrease in the total number of PrEP prescriptions and a 25% decrease in the total number of new PrEP users between March 2020 and March 2021 compared to predicted numbers assuming the COVID-19 pandemic shutdown had never occurred. We observed a partial rebound in the number of new users in June 2020, but then followed by declining numbers towards the end of 2020. We observed another rebound in the number of new users after December 2020, when the COVID-19 vaccines became available.

Our finding of reductions in PrEP prescriptions was consistent with other studies that found declines in the use of preventive and elective healthcare services [6, 7]. PrEP requires adherent and persistent use for its effectiveness as a biomedical tool for HIV prevention. Persons who stopped taking PrEP but had ongoing risk behaviors during the pandemic might have acquired and subsequently transmitted HIV infection. At least one study found that HIV testing rates decreased substantially during the COVID-19 pandemic [23], which may be partially due to decreases in PrEP

prescriptions. HIV testing is an important part of integrated PrEP services, that is, PrEP users are required to have a negative HIV test result prior to initiating PrEP, and testing is recommended every 3 months at follow-up visits before a new prescription is provided for PrEP continuation. Decreases in PrEP initiation and ongoing PrEP prescriptions resulted in fewer HIV tests, as well as fewer opportunities to diagnose HIV.

The pandemic caused more disruption in new PrEP prescriptions among younger persons. PrEP coverage was lower among persons in younger age groups prior to the COVID pandemic, and it decreased even more during the pandemic shutdown [14]. Young persons are typically less likely to adhere to and persist with daily medications [24-26]. In addition, young persons might have had less access to care during the pandemic compared to older persons [27, 28], likely because older persons had established relationships with health care providers prior to the shutdown. Decreased PrEP uptake and persistence due to lack of access to care, along with lack of perceived HIV risk, might have resulted in increased HIV transmission risk among persons in younger populations [29]. Innovative interventions such as risk assessment tools, educational messages, PrEP provider locator tools, and other resources linked to social media apps could help reach this population to improve their PrEP initiation, adherence, and persistence.

We also observed larger reductions in PrEP use among persons with commercial health insurance. A study that reported on an analysis of the IQVIA database found that out-of-pocket payments for PrEP were lower among persons with Medicaid or Medicare than among those with commercial insurance [30]. With loss of employment and health insurance coverage during the COVID-19 shutdown, high copayments might have been a barrier to PrEP use among persons with commercial insurance or those who paid with cash. Starting January 2021, most health plans were required to offer PrEP to their beneficiaries without copays under the Affordable Care Act (ACA), which can increase access to PrEP by removing financial barriers.

The South had the least changes in PrEP prescriptions compared to other regions, which might be attributed to individual states' variation in COVID -19- policies as well as their pre-COVID-19 PrEP use. Increases in new PrEP users were observed in some Southern states like Delaware and Florida during the study period. Most state governments declared a state of emergency and required shutdowns, resulting in increased time spent at home in the first half of 2020 [31, 32]. These shutdowns affected non-essential businesses, most schools, and non-emergent/urgent health care venues. Timing of enacting and lifting of stay-at-home and closure orders as well as type of the restrictions varied by state and might have affected both access to health care and a person's comfort level to seek it. We observed that the magnitude of decreased PrEP prescriptions and new PrEP users during the COVID-19 pandemic varied across states, possibly related to the timing or severity of each state's COVID-related policy enactments [3, 4]. The variation in the size of the decreases might have also depended on the number of persons using PrEP prior to the COVID-19 pandemic. Further research is needed to better understand state-level variation and the factors that affected it.

Our study has some limitations. We did not capture PrEP prescriptions from closed health systems such as health maintenance organizations. We might have over- or under-estimated the COVID-19 impact on PrEP prescriptions in some states due to low precision in the measurement of some state-level numbers. Decreased PrEP prescriptions could be due to lack of access to care or decreased risk behavior during the pandemic [33]; we were unable to distinguish between these factors. Additionally, some users might take event-driven (or 2-1-1) PrEP regimens, even if their refill patterns changed, which could not be observed in this analysis. Race/ethnicity data were available for fewer than 40% of persons prescribed PrEP. The race/ethnicity data that were available in the IQVIA database were from the linked Experian consumer database that likely included larger proportions of persons who were white, older, and with higher incomes. Because of the lack of

race/ethnicity data in the IQVIA database for most PrEP users, our finding of no significant differences by race/ethnicity should be interpreted with caution.

In conclusion, our analysis of a national pharmacy database found that the COVID-19 pandemic disrupted an increasing trend in PrEP use in the United States, highlighting the need for innovative interventions to maintain access to HIV prevention services during similar emergencies. Strategies like the expansion of telemedicine and HIV self-testing or self-sample collection can provide access to PrEP care during such emergencies or as a convenient health service option for some PrEP users. Ongoing monitoring of trends in PrEP prescriptions and PrEP users is needed to assess whether the impact of the COVID-19 pandemic abated after shutdown orders were lifted and as the vaccination rate among the population increased. Further studies are needed to understand the population-level implications of decreased PrEP use during the COVID-19 pandemic on HIV transmission.

NOTES

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FIGURE LEGENDS

Figure 1a. Observed weekly number of PrEP prescriptions and modeled trend* from January 1, 2017 through March 31, 2021, IQVIA Real World Data—Longitudinal Prescriptions Database

Figure 1b. Observed weekly number of new PrEP users and modeled trend* from January 1, 2017 through March 31, 2020, IQVIA Real World Data—Longitudinal Prescriptions Database

***** The observed weekly numbers were identified in analyses of the IQVIA Real World Data—Longitudinal Prescriptions Database (circles). The modeled trend was fitted using an interrupted time series model adjusted for seasonality (solid line).

Figure 2a. Modeled trends in weekly number of PrEP prescriptions with and without the COVID-19 pandemic from March 15, 2020 through March 31, 2021, IQVIA Real World Data—Longitudinal Prescriptions Database

Figure 2b. Modeled trends in weekly number of new PrEP users with and without the COVID-19 pandemic from March 15, 2020 through March 31, 2021, IQVIA Real World Data—Longitudinal Prescriptions Database

Note: The trends in number of PrEP prescriptions and new PrEP users from January 1, 2017 through March 31, 2020 (solid line) was fitted using an interrupted time series model adjusted for seasonality of the observed numbers identified in analyses of the IQVIA Real World Data—Longitudinal Prescriptions Database. The expected trends in PrEP prescriptions and new PrEP users from March 15, 2020 through March 31, 2021 were predicted by the same model assuming the COVID-19 pandemic did not occur (dashed line). The shade represents 95% confidence intervals.

Table 1: Observed and expected number of PrEP prescriptions and new PrEP users and predicted percent reduction* by month from March 15, 2020 through March 31, 2021, IQVIA Real World Data—Longitudinal Prescriptions Database

	PrEP Prescriptions				New PrEP Users			
	Observed No.	Expected No.	% Reduction	95% CI	Observed No.	Expected No.	% Reduction	95% CI
Total	825,239	1,058,162	22.0	19.1 – 24.8	125,793	167,720	25.0	20.9 – 28.9
Month								
March 15-31, 2020	31,151	32,545	4.3	-0.8 – 8.8	4,550	5,668	19.7	13.6 – 25.1
April 2020	68,502	85,587	20.0	15.5 – 24.0	8,452	13,960	39.5	34.5 – 43.7
May 2020	53,878	69,344	22.3	17.9 – 26.3	7,062	10,740	34.2	28.8 – 38.9
June 2020	58,442	70,747	17.4	12.7 – 21.6	9,266	11,098	16.5	9.6 – 22.4
July 2020	70,520	91,338	22.8	18.4 – 26.7	11,291	15,434	26.8	20.9 – 32.0
August 2020	58,477	74,572	21.6	17.2 – 25.5	9,859	12,778	22.8	16.7 – 28.2
September 2020	58,971	76,951	23.4	19.1 – 27.2	9,588	12,622	24.0	18.0 – 29.3
October 2020	80,256	99,207	19.1	14.5 – 23.2	12,790	15,344	16.6	9.8 – 22.5
November 2020	63,448	79,510	20.2	15.7 – 24.2	8,499	11,669	27.2	21.2 – 32.3
December 2020	74,199	99,625	25.5	21.4 – 29.2	10,161	14,697	30.9	25.2 – 35.7
January 2021	64,991	82,923	21.6	17.2 – 25.6	10,209	12,935	21.1	14.6 – 26.6
February 2021	63,782	86,357	26.1	21.9 – 29.9	11,115	13,919	20.1	13.6 – 25.8
March 2021	78,622	109,457	28.2	23.9 – 32.0	12,951	16,857	23.2	16.5 – 28.9

*The expected numbers of PrEP prescriptions and new PrEP users were predicted using interrupted time series models fit using a generalized linear quasi-Poisson model adjusted for seasonality.

Table 2: Observed and expected number of PrEP prescriptions and new PrEP users and predicted percent reduction* from March 15, 2020 through March 31, 2021, stratified by demographic characteristics, IQVIA Real World Data—Longitudinal Prescriptions Database

Characteristics	PrEP Prescriptions				New PrEP Users			
	Observed No.	Expected No.	% Reduction	95% CI	Observed No.	Expected No.	% Reduction	95% CI
Total	825,239	1,058,162	22.0	19.1 – 24.8	125,793	167,720	25.0	20.9 – 28.9
Sex								
Male	777,508	997,928	22.1	19.2 – 24.9	110,327	146,369	24.6	20.4 – 28.6
Female	47,412	59,958	20.9	17.2 – 24.5	15,202	21,599	29.6	25.2 – 33.8
Age Group (years)								
16–29	228,206	294,897	22.6	18.0 – 27.0	51,145	70,623	27.6	22.6 – 32.2
30–39	297,576	387,818	23.3	20.5 – 26.0	40,113	54,126	25.9	21.5 – 30.0
40–49	152,494	188,931	19.3	16.3 – 22.2	17,199	21,945	21.6	17.0 – 26.0
50+	146,963	186,800	21.3	18.2 – 24.3	17,336	21,279	18.5	13.7 – 23.1
Race/Ethnicity								
White	202,283	253,142	20.1	17.3 – 22.8	21,724	30,418	28.6	24.9 – 32.1
Black	40,074	47,967	16.5	13.1 – 19.7	6,383	8,274	22.9	17.7 – 27.6
Hispanic	48,115	59,726	19.4	16.1 – 22.6	6,665	8,775	24.0	19.2 – 28.6
Other	12,195	15,738	22.5	18.7 – 26.2	1,352	1,916	29.4	22.3 – 36.0
Unknown	522,572	681,756	23.3	20.3 – 26.2	89,669	118,455	24.3	19.8 – 28.6
Payer Type								
Commercial	456,859	597,358	23.5	20.7 – 26.3	52,494	74,090	29.1	25.0 – 33.1
Public	106,426	125,232	15.0	11.5 – 18.4	19,048	26,534	28.2	23.5 – 32.6
Cash	13,876	15,900	12.7	6.8 – 18.3	4,923	6,336	22.3	15.8 – 28.3
Other	110,287	137,718	19.9	15.7 – 23.9	28,213	31,606	10.7	5.0 – 16.1
Region								
Northwest	177,115	245,188	27.8	25.1 – 30.3	22,188	33,579	33.9	29.5 – 38.0
Midwest	124,985	160,258	22.0	18.8 – 25.1	15,533	23,925	35.1	30.7 – 39.2
South	298,094	360,993	17.4	14.1 – 20.6	57,032	66,619	14.4	9.5 – 19.1
West	223,347	295,562	24.4	21.4 – 27.4	30,787	44,556	30.9	26.6 – 34.9

*Expected number and predicted percent reduction during March 15, 2020–March 31, 2021 were estimated from interrupted time series models fit using a generalized linear quasi-Poisson model adjusted for seasonality.

Table 3: Observed and expected number of PrEP prescriptions and new PrEP users and predicted percent reduction* from March 15, 2020 through March 31, 2021, stratified by states, IQVIA Real World Data—Longitudinal Prescriptions Database

	PrEP Prescriptions				New PrEP Users			
State	Observed No.	Expected No.	% Reduction	95% CI	Observed No.	Expected No.	% Reduction	95% CI
Alabama	2,741	3,568	20.6	13.9 - 26.7	337	581	21.2	5.1 - 34.7
Alaska	424	649	33.8	21.4 - 44.2	79	132	38.5	13.1 - 56.4
Arizona	13,960	17,220	20.9	16.8 - 24.8	1,729	2,454	30.1	23.6 - 35.9
Arkansas	1,450	1,588	7.9	-2.2 - 16.9	289	348	13.7	-5.8 - 29.6
California	104,300	137,000	26.6	23.3 - 29.7	13,140	20,080	34.9	30.2 - 39.2
Colorado	8,670	10,620	19.4	14.9 - 23.6	1,427	1,869	22.8	15.7 - 29.3
Connecticut	4,380	5,623	22.6	17.8 - 27.1	612	1,097	40.0	32.0 - 47.1
Delaware	2,731	2,469	-9.9	-20.3 - -0.4	262	224	-26.4	-57.1 - -1.7
District of Columbia	13,380	18,240	27.7	23.8 - 31.5	1,198	2,142	42.6	36.0 - 48.5
Florida	62,420	67,790	10.2	5.4 - 14.8	17,220	15,580	-6.9	-17.0 - 2.4
Georgia	19,120	22,680	17.4	13.4 - 21.2	2,814	4,312	35.4	29.9 - 40.4
Hawaii	1,604	1,853	14.0	5.9 - 21.3	252	367	28.1	13.3 - 40.4
Idaho	1,322	1,289	2.1	-10.8 - 13.6	239	290	25.8	4.8 - 42.1
Illinois	37,570	49,780	25.9	22.2 - 29.4	3,565	5,940	38.4	32.4 - 44.0
Indiana	6,911	7,429	7.7	2.3 - 12.8	886	1,330	28.1	19.1 - 36.0
Iowa	2,746	3,361	19.1	12.4 - 25.3	414	624	33.6	22.8 - 42.8
Kansas	2,925	3,274	11.8	-1.0 - 23.0	408	491	17.5	1.3 - 30.9
Kentucky	2,667	3,560	26.5	20.4 - 32.0	430	778	43.6	34.9 - 51.0
Louisiana	14,380	14,600	2.9	-2.9 - 8.4	3,120	3,681	16.2	6.3 - 25.0
Maine	1,274	1,715	27.1	18.0 - 35.2	187	288	32.3	15.2 - 46.0
Maryland	7,660	10,720	29.6	25.8 - 33.3	1,026	2,063	47.1	41.2 - 52.3
Massachusetts	17,260	26,950	38.2	34.6 - 41.6	2,129	4,037	46.5	41.5 - 51.0
Michigan	9,747	13,110	27.2	22.9 - 31.2	1,374	2,213	35.5	28.3 - 42.1
Minnesota	8,365	9,897	16.8	12.4 - 20.9	929	1,543	39.2	32.2 - 45.5
Mississippi	1,541	1,963	21.0	12.1 - 29.1	349	482	22.6	6.5 - 35.9
Missouri	6,777	9,139	28.0	23.6 - 32.1	876	1,543	43.1	36.1 - 49.4
Montana	505	640	21.9	9.1 - 33.0	104	163	36.2	10.7 - 54.5

Nebraska	1,508	1,564	2.3	-7.9 - 11.6	237	262	8.5	-13.8 - 26.4
Nevada	5,059	6,037	15.5	9.9 - 20.9	879	1,360	32.5	22.7 - 41.1
New Hampshire	1,073	1,226	3.9	-8.2 - 14.7	231	313	29.1	12.9 - 42.3
New Jersey	16,570	30,220	47.1	43.0 - 51.0	1,598	2,760	39.7	33.2 - 45.6
New Mexico	2,316	2,998	23.5	17.3 - 29.3	359	502	27.4	11.7 - 40.3
New York	65,650	94,400	31.0	28.3 - 33.7	7,662	13,000	36.1	31.0 - 40.8
North Carolina	11,060	15,110	28.3	24.0 - 32.2	1,948	2,795	29.3	22.2 - 35.8
North Dakota	348	402	17.3	-0.2 - 31.8	70	95	30.1	-1.8 - 52.0
Ohio	12,650	14,410	13.3	9.6 - 16.9	1,983	2,668	26.4	20.0 - 32.3
Oklahoma	2,602	2,828	9.3	1.1 - 16.8	582	668	15.2	0.1 - 28.0
Oregon	6,966	8,247	16.3	11.7 - 20.7	1,213	1,499	19.3	9.9 - 27.8
Pennsylvania	24,790	23,890	-5.0	-13.4 - 2.7	2,900	3,432	10.7	1.7 - 18.8
Puerto Rico	834	1,042	24.2	12.6 - 34.3	113	153	33.3	10.5 - 50.3
Rhode Island	2,226	2,752	22.1	15.3 - 28.3	276	495	38.7	26.3 - 49.0
South Carolina	3,105	3,940	12.8	4.8 - 20.1	600	897	6.0	-15.2 - 23.3
South Dakota	217	1,475	84.1	77.4 - 88.8	41	130	61.8	44.9 - 73.4
Tennessee	8,829	12,460	28.0	22.4 - 33.2	1,052	1,572	27.2	17.1 - 36.1
Texas	57,870	73,040	22.0	18.0 - 25.7	8,717	10,820	18.4	12.1 - 24.2
Utah	4,635	5,561	17.2	12.1 - 21.9	657	837	19.9	8.0 - 30.2
Vermont	526	661	22.8	10.9 - 33.1	74	144	43.7	23.4 - 58.6
Virginia	7,770	9,740	22.7	18.2 - 26.8	1,297	2,221	42.7	36.9 - 48.0
Washington	19,150	25,660	27.2	24.1 - 30.3	2,854	3,640	23.1	12.7 - 32.3
West Virginia	679	1,036	34.1	25.0 - 42.1	139	364	60.9	49.5 - 69.8
Wisconsin	4,173	5,649	28.8	24.3 - 33.2	564	1,099	48.9	41.8 - 55.0
Wyoming	160	184	11.6	-18.2 - 33.9	25	44	39.8	-4.8 - 65.4

*Expected number and predicted percent reduction during March 15, 2020–March 31, 2021 were estimated from interrupted time series models fit using a generalized linear quasi-Poisson model adjusted for seasonality.

Figure 1a. Observed weekly number of PrEP prescriptions and modeled trend* from January 1, 2017 through March 31, 2021, IQVIA Real World Data—Longitudinal Prescriptions Database

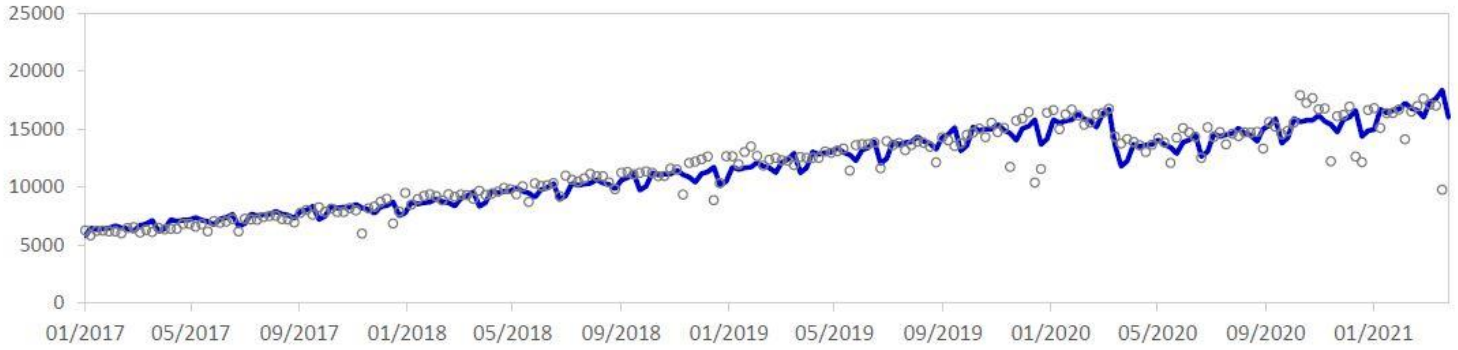
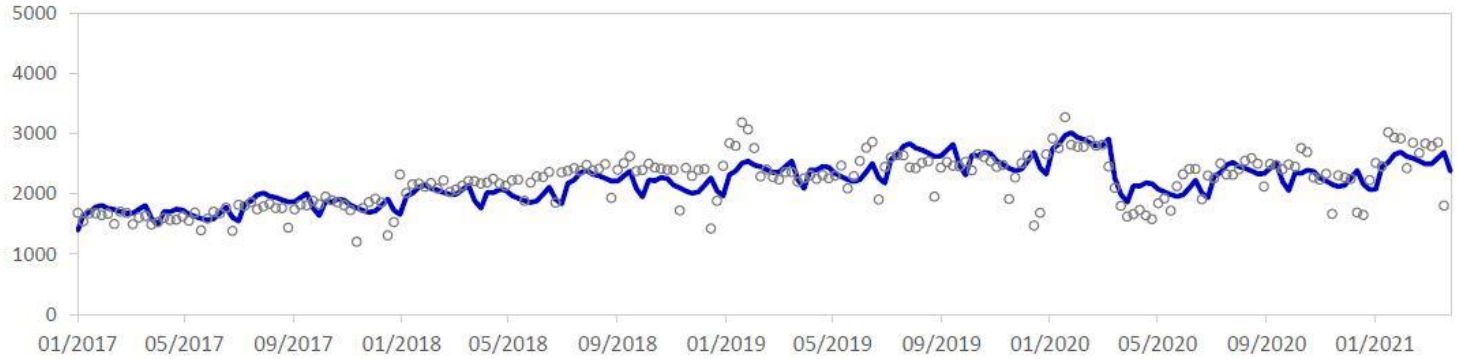


Figure 1b. Observed weekly number of new PrEP users and modeled trend* from January 1, 2017 through March 31, 2020, IQVIA Real World Data—Longitudinal Prescriptions Database



* The observed weekly numbers were identified in analyses of the IQVIA Real World Data—Longitudinal Prescriptions Database (circles). The modeled trend was fitted using an interrupted time series model adjusted for seasonality (solid line).

Figure 2a. Modeled trends in weekly number of PrEP prescriptions with and without the COVID-19 pandemic from March 15, 2020 through March 31, 2021, IQVIA Real World Data—Longitudinal Prescriptions Database

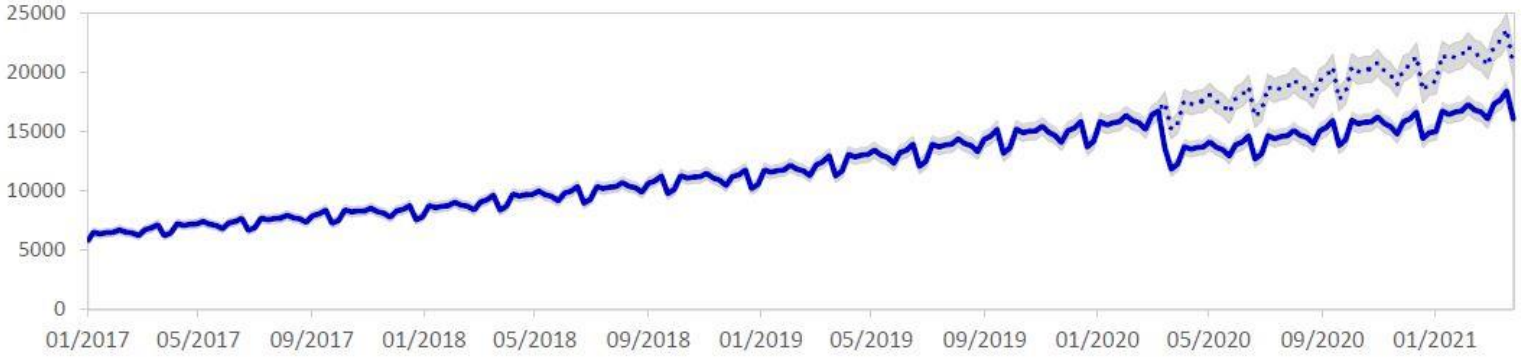
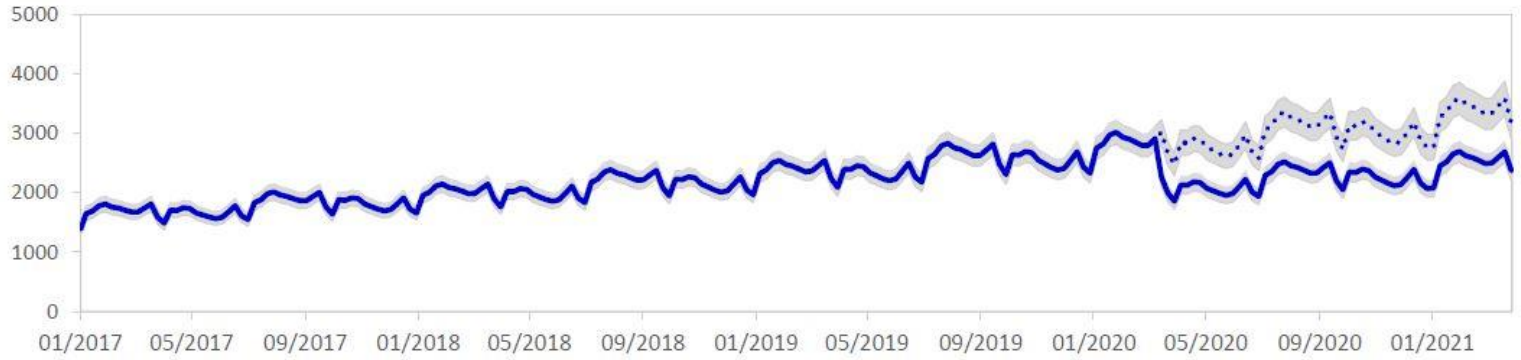


Figure 2b. Modeled trends in weekly number of new PrEP users with and without the COVID-19 pandemic from March 15, 2020 through March 31, 2021, IQVIA Real World Data—Longitudinal Prescriptions Database



Note: The trends in number of PrEP prescriptions and new PrEP users from January 1, 2017 through March 31, 2020 (solid line) was fitted using an interrupted time series model adjusted for seasonality of the observed numbers identified in analyses of the IQVIA Real World Data—Longitudinal Prescriptions Database. The expected trends in PrEP prescriptions and new PrEP users from March 15, 2020 through March 31, 2021 were predicted by the same model assuming the COVID-19 pandemic did not occur (dashed line). The shade represents 95% confidence intervals.