AIDS and Behavior
https://doi.org/10.1007/s10461-022-03886-0

ORIGINAL PAPER

Assessing the Impact of COVID-19 on Retention in HIV Primary Care: A Longitudinal Multisite Analysis

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Accepted: 30 September 2022

Abstract
We compared retention in care outcomes between a pre-COVID-19 (Apr19-Mar20) and an early-COVID-19 (Apr20-Mar21) period to determine whether the pandemic had a significant impact on these outcomes and assessed the role of patient sociodemographics in both periods in individuals enrolled in the Data for Care Alabama project (n = 6461). Using scheduled HIV primary care provider visits, we calculated a kept-visit measure and a missed-visit measure and compared them among the pre-COVID-19 and early-COVID-19 periods. We used logistic regression models to calculated odds ratios (OR) and accompanying 95% confidence intervals (CI). Overall, individuals had lowers odds of high visit constancy [OR (95% CI): 0.85 (0.79, 0.92)] and higher odds of no-shows [OR (95% CI): 1.27 (1.19, 1.35)] during the early-COVID-19 period. Compared to white patients, Black patients were more likely to miss an appointment and transgender people versus cisgender women had lower visit constancy in the early-COVID-19 period.

Keywords HIV · retention in care · pre-COVID-19 · COVID-19 · no show · visit constancy

Introduction

On March 11, 2020, the World Health Organization declared SARS-CoV-2 (novel coronavirus disease 2019, or "COVID-19") a pandemic [1]. The sudden emergence of the COVID-19 pandemic led to abrupt changes in the healthcare system across all fields. In efforts to minimize infection risk and ensure continuity of care during COVID-19, much ambulatory healthcare delivery switched from in-person to telemedicine, especially for chronic illness care management [2]. Efforts put in place to minimize the spread of COVID-19, such as stay-at-home recommendations and attending work and school from home, reduced human interaction and increased isolation [3, 4]. For people with HIV (PWH), who are already at increased risk of isolation due to internalized stigma associated with HIV [5], COVID-19-induced isolation may exacerbate feelings of loneliness. While social isolation has shown to worsen health outcomes and even increase mortality risk[6], isolation in PWH may worsen HIV-related health outcomes due to increased depression [7, 8], which is negatively associated with retention in HIV care[9, 10]. Additionally, surveys showed telehealth to be a cause of concern for effective communication and physical examination in PWH; this may lead to suboptimal retention in care in PWH [11, 12].

While clinical measures of retention in care have, up until this point, relied on face-to-face visits to calculate this indicator of HIV health, the emergence of COVID-19 has

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Published online: 02 November 2022

temporarily, if not permanently, changed the way we conceptualize HIV primary care visit attendance with the emergent role of telehealth [13]. Retention in primary HIV care is a complex phenomenon longitudinally measuring multiple visits over varying intervals of time without a single gold standard method for its measurement [14]. Currently, six methods (three kept-visit and three missed-visit measures) are recommended for measurement of retention in care [14]. Since missed-visit and kept-visit measures capture distinct aspects of retention in care behaviors in PWH (i.e., missing visits versus attending visits), researchers have recommended using at least one missed-visit measure and one kept-visit measure when studying retention in care [14–16]. Following the emergence of COVID-19, some researchers have also recommended including telehealth as a measure of HIV primary care attendance, thereby expanding and adapting the metrics further [13]. While some single-cohort studies have examined retention in care outcomes before and during COVID-19 using a single measure (e.g.,[17, 18]), to our knowledge, no research to date has examined trends in retention in care across multiple clinic cohorts, affording a larger as well as a more heterogeneous sample, using both kept- and missed-visit measures.

Therefore, the objective of this research was to examine the impact of early-COVID-19 on retention in care by comparing visit constancy (kept-visit measure) and no-show dichotomous (missed-visit measure) outcomes in the pre-COVID-19 (Apr19-Mar20) vs. early-COVID-19 (Apr20-Mar21) period using a longitudinal multi-site sample. This analysis also assessed the role of patient sociodemographics on retention in care both prior to and during early-COVID-19 to assess if there were distinct sociodemographic trends during the two measurement periods.

Methods

This study was conducted as a part of the Data for Care Alabama (D4C) project, which is aimed at improving retention in care in PWH through evidence-based enhanced personal contact and stay connected methods [19]. The D4C project is a consortium of seven sites funded by the Ryan White HIV/AIDS Program throughout the state of Alabama, which include the University of Alabama at Birmingham (UAB) 1917 Clinic, UAB Family Clinic, Health Services Center, Thrive, Medical Advocacy and Outreach, University of South Alabama, and Unity Wellness Center. As a part of the D4C project, all sites have been reporting client-level data routinely on sociodemographics, HIV viral loads, CD4 counts, and scheduled HIV-related primary care provider (PCP) appointments since 2019. All sites followed the D4C codebook and reported data uniformly on all variables The implementation of the D4C intervention occurred in 2018 at the UAB 1917 Clinic, and has been delayed at six of the seven participating clinics as a result of the COVID-19 pandemic such that the intervention was not introduced at any of the seven sites during the observation period of this study.

For this study, a retrospective cohort design was used in which individuals were followed from April 1st, 2019 to March 31st, 2021 using D4C data. The two-year study period was divided into a "pre-COVID" period (April 1st, 2019-March 31st, 2020) and an "early-COVID" period (April 1st, 2020- March 31st, 2021). April 1 was chosen as the start date for the early-COVID period because clinics' operating procedures and care practices were heavily disrupted during the first few weeks of the pandemic. Only individuals that had ≥ 1 scheduled PCP visit in the pre-COVID period were included to better assess trends among patients already established in care. The current study was approved by the UAB Institutional Review Board as part of D4C.

Outcome Variables

Using information on scheduled PCP visits, two outcomes, no-show dichotomous (a missed-visit measure) and visit constancy (a kept-visit measure), were created. For each outcome variable, two outcome measures, one for the pre-COVID period and one for the early COVID period, were created. The status of PCP visits was categorized as *arrived*: keeping a scheduled appointment, *no-show*: missing a scheduled appointment without prior cancelation, *cancelled*: missing a scheduled appointment with prior cancelation, *rescheduled/bumped*: appointment re-scheduled by clinic.

No-show Dichotomous

This measure assesses an individual having ≥ 1 no-show in a pre-determined study period [14]. The variable was categorized as having 0 vs. ≥1 no-show in the pre-COVID-19 period and early-COVID-19 period.

Visit Constancy

This measures attendance of ≥ 1 scheduled PCP visit within a pre-established time interval during a pre-specified follow-up period [14]. To create this variable, only *arrived* PCP visits were used. For this study, individuals were followed for two consecutive 6-month intervals in the pre-COVID-19 period and early-COVID-19 period (Fig. 1). The decision to create 6-month intervals was based on the stable clinical condition of the majority of the study population that resulted in a scheduled PCP visit only once every six months. For this outcome, if an individual arrived to

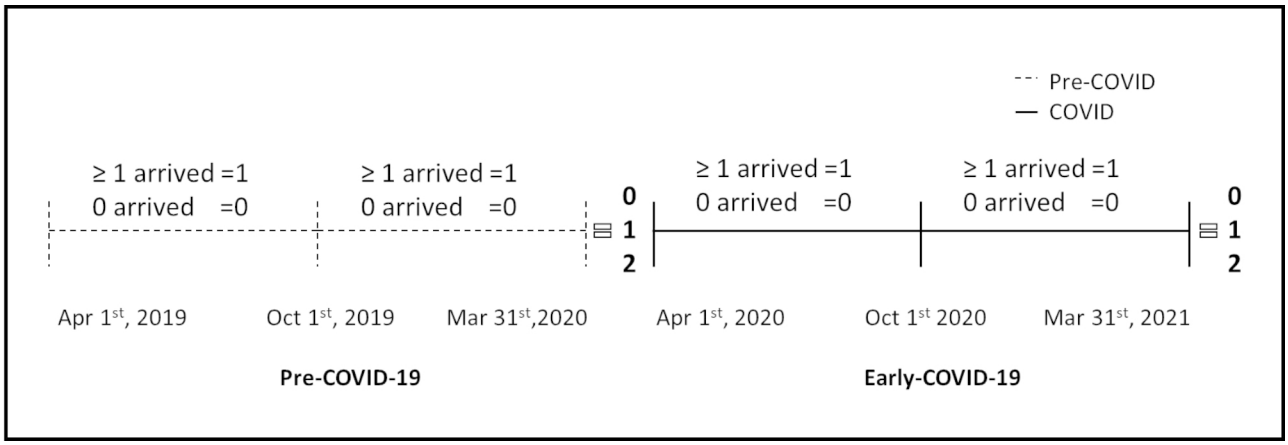

Fig. 1 Illustration of the Visit Constancy Measure

≥ 1 PCP visit in the 6-month interval, they were assigned a score of 1, the maximum attainable score; therefore, for one study period (pre-COVID-19 and early-COVID-19) was 2. Individuals with a high visit constancy received a score of 2, while those with a low visit constancy received a score of 0 or 1.

Exposure Variables/Covariates

Sociodemographics included age and annual income as continuous variables; gender categorized as cisgender male, cisgender female, and transgender (male-to-female, female-to-male, unspecified transgender; all groups were combined owing to small sample sizes); race/ethnicity categorized as Black, White, and "other" (Asian, Native Hawaiian/Pacific Islander, American Indian or Alaska Native, and other including mixed race; the small sample size for each of these races necessitated that these categories were combined); housing status categorized as permanent/stable and temporary/unstable; and HIV risk factor categorized as men who have sex with men (MSM), heterosexual contact, and "other" [injecting drug use (IDU), hemophilia/coagulation disorder, receipt of blood transfusion, blood components, or tissue, perinatal transmission, and MSM/IDU].

Statistical Analysis

Descriptive statistics were calculated for individuals having 0, and ≥ 1 no-shows in the pre-COVID-19 period with the exposure variables at baseline. Frequencies and proportions for categorical variables and median and interquartile range for continuous variables were calculated. For the bivariate analyses, Cochran-Mantel-Haenszel tests for categorical and Kruskal-Wallis tests for continuous variables were conducted. Additionally, to examine association between no-shows categorized as 0, 1, and ≥ 2 and sociodemographics, descriptive statistics and bivariate analyses were also carried out for the pre-COVID-19 period. Moreover, to compare no-shows with sociodemographics between the pre-COVID-19 and early-COVID-19 period, descriptive statistics and bivariate analyses were also carried out with no-shows in the –early-COVID-19 period. To examine the impact of early-COVID-19 on HIV retention in care, no-shows and visit constancy were compared between pre-COVID-19 vs. early-COVID-19 period. A sensitivity analysis was carried out comparing the no-shows, categorized as ≤ 1 and ≥ 2, between pre-COVID-19 and early-COVID-19 period. Since March 2020 was transitional month, when many visit-related activities were unsettled, a sensitivity analysis was carried out comparing no-shows and visit constancy among pre-COVID-19 and early-COVID-19 period excluding visits from March 2020. Additionally, to examine if retention in care outcomes were different in the earlier and the later phase of early-COVID-19- pandemic, no-shows and visit constancy were compared among the first interval (Apr 1st, 2020 to Sep 31st 2020) and second interval (Oct 1st, 2020 to Mar 31st, 2021) of early-COVID-19; the no-show measure was categorized as having ≥ 1 vs. 0 no-show and visit constancy was categorized as attending ≥ 1 vs. 0 scheduled visits in the first and second 6-month period. For these analyses, logistic regression models using generalized estimating equations were fit accounting for repeat measures in individuals and within sites.

To assess the association between the sociodemographic variables and outcome variables, logistic regression models with an interaction term for each covariate/confounder with time period (pre-COVID-19 and early-COVID-19) were fit to calculate crude and adjusted odds ratios (OR) and accompanying 95% confidence interval (CI). First, the impact of exposure variables with no-show dichotomous was assessed as odds of having ≥ 1 vs. 0 no-show. A sensitivity analysis was carried out assessing relationships between

Table I Descriptive Characteristics of the Study Population at Baseline (n = 6,410)

Variables	%	0 (72.3%)	≥ 1 (27.7%)	P-value
Age ‡		48 (36, 57)	40 (31, 51)	**< 0.0001**
Income ‡		1816 (600, 10,000)	964 (0, 10,080)	**< 0.0001**
Gender †				**0.0013**
Men	69.9	3276 (70.7)	1203 (67.9)	
Women	29.6	1344 (29.0)	552 (31.1)	
Transgender	0.6	17 (0.4)	18 (1.0)	
Race/Ethnicity†				**< 0.0001**
White	30.6	1555 (33.5)	403 (22.7)	
Black	67.4	2981 (64.3)	1340 (75.6)	
Other	2.0	101 (2.2)	30 (1.7)	
Housing Status†				**< 0.0001**
Permanent/stable	93.7	4409 (95.1)	1600 (90.3)	
Temporary/unstable	6.3	228 (4.9)	173 (9.8)	
HIV Risk Factor†				0.0666
MSM	49.4	2313 (49.9)	851 (48.0)	
Heterosexual	45.7	2110 (45.5)	817 (46.1)	
Other	5.0	214 (4.6)	105 (5.9)	
Site				**< 0.0001**
1	48.8	2442 (52.7)	686 (38.7)	
2	3.1	102 (2.2)	98 (5.5)	
3	11.7	512 (11.0)	239 (13.5)	
4	6.5	326 (7.0)	92 (5.2)	
5	21.5	973 (21.0)	405 (22.9)	
6	2.7	98 (2.1)	77 (4.3)	
7	5.6	184 (4.0)	176 (9.9)	

[a]‡Median (interquartile range); † N (%)

[b]P-value were calculated using Cochran-Mantel-Haenszel test for categorical and Kruskal-Wallis test for continuous variables

*Bold denotes significance

[c]Transgender includes individuals transgender, transgender male-to-female, and transgender female-to-male

[d]Other race includes Asian, Native Hawaiian/Pacific Islander, American Indian or Alaska Native, and Other (including mixed race)

[e]Other risk factor includes Injection drug use (IDU), hemophilia/coagulation disorder, receipt of blood transfusion, blood components, or tissue, perinatal transmission, and MSM/IDU.

sociodemographics and no-show dichotomous categorized as ≤ 1 or ≥ 2 no-show. Next, the impact of exposure variables on visit constancy was assessed as odds of an individual attending ≥ 1 scheduled PCP visit in both intervals (high visit constancy) vs. not attending ≥ 1 scheduled PCP visit in ≥ 1 interval (low visit constancy). All sociodemographics variables and site were included in the adjusted models. All analyses were carried out using SAS 9.4 [20].

Results

During the two-year study period, a total of 60, 295 PCP visits were scheduled (pre-COVID-19: 45.9%; early-COVID-19: 54.1%). Of all the pre-COVID-19 visits, 68.1% arrived, 12.8% were no-shows, 10.8% cancelled, and 8.4% rescheduled/bumped. Of the visits during early-COVID-19, 56.8% arrived, 12.0% were no-shows, 18.4% cancelled, and 12.8% rescheduled/bumped. A larger number of scheduled visits in the early-COVID-19 period may be attributed to the large proportion of cancelled visits. Although visit type (e.g., in clinic, telehealth) was not systematically captured in the pre-COVID-19 period due to less emphasis on telehealth prior to the pandemic, it was reported by most sites during the COVID-19 period. Among all scheduled visits in the COVID-19 period, 70.8% were in-person, 6.9% were video visits, and 22.3% were telephone visits (7.6% missing). Furthermore, the no-show rate among each visit type was 13.5% for in-person visits, 8.7% for video visits, and 9.7% for telephone visits during the COVID-19 period. Of all the cancelled visits in the early-COVID-19 period, 71.4% were in-person, 6.5% were video, and 22.1% were telephone.

When looking at individual-level data, 8,154 unique individuals had ≥ 1 scheduled visit in the pre-COVID-19 period. Of these, only 7,558 individuals (92.7%) had ≥ 1 scheduled visit in the COVID-19 period. To follow the same study sample, individuals without data in the COVID-19 period (n = 596) were excluded. Additionally, after excluding individuals with missing data on age (n = 197), race/ethnicity (n = 48), gender (n = 60), housing status (n = 407), income (n = 223), HIV risk factor (n = 213), 6,410 individuals were included in the analyses.

Among the 6,410individuals, 72.3% had zero and 27.7% had ≥ 1 no-shows in the pre-COVID-19 period, whereas 67.4% had zero and 32.6% had ≥ 1 no-shows in the COVID-19 period (Cochran-Mantel-Haenszel test p: <0.0001). The study population had a median age of 46 years and were predominantly Black (67.4%) and cisgender men (69.9%). The bivariate analysis showed that the individuals with ≥ 1 no-show were younger, had lower income, were more likely women, Black, and had a temporary/unstable housing status (Table I). The descriptive statistics and bivariate analyses with no-show categorized as 0, 1, ≥ 2 showed similar findings (Supplementary table I). Overall, 27.7% individuals in the pre-COVID-19 period and 32.6% individuals in the COVID-19 period had ≥ 1 no-show, whereas,

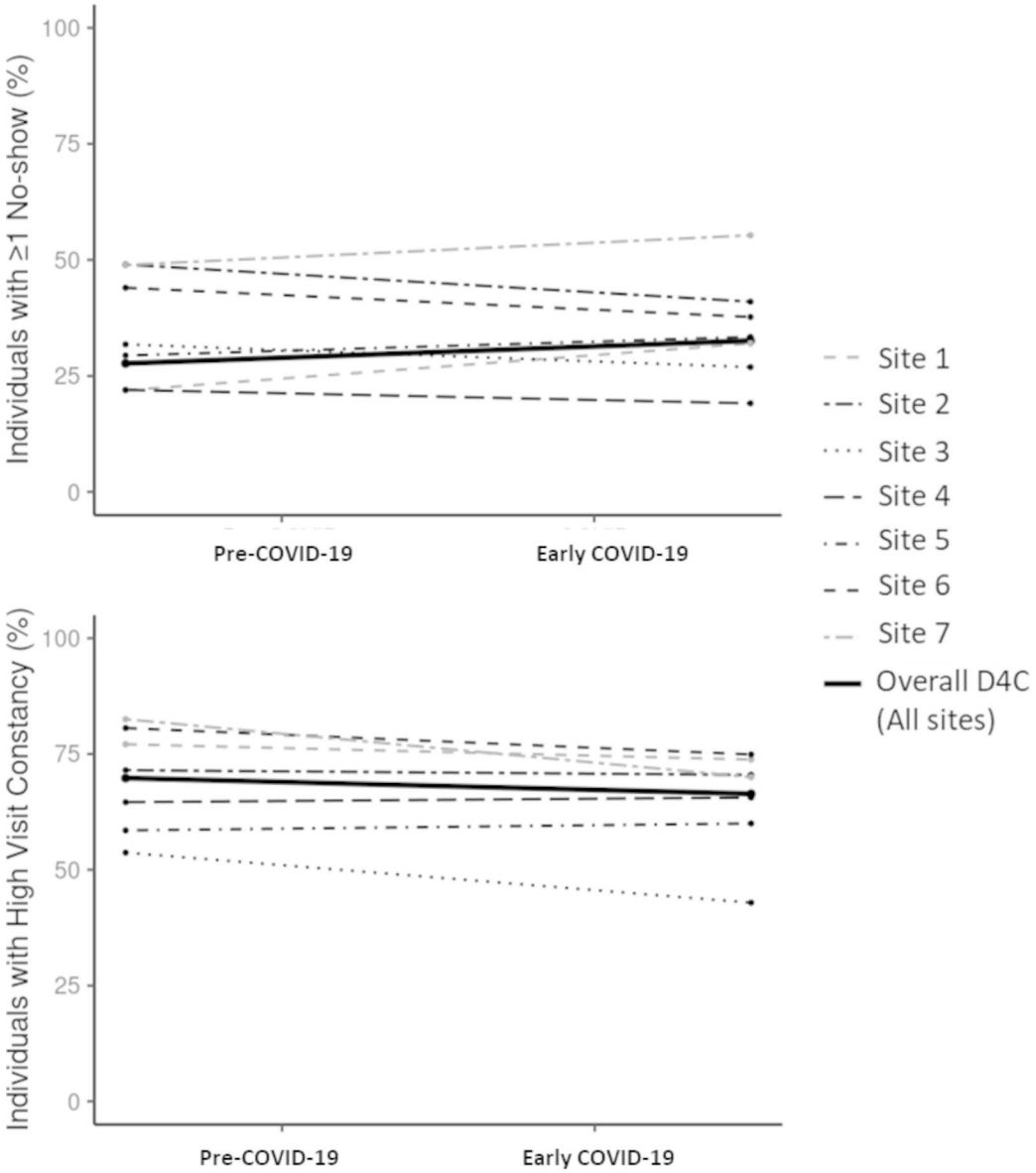

Fig. 2 Trends in the Proportion of Individuals with ≥ 1 No-show and High Visit Constancy between Pre-COVID-19 and early-COVID-19 Period

69.8% in the pre-COVID-19 and 66.4% in the COVID-19 period had high visit constancy (Fig. 2); differences in no-shows and visit constancy were also noticed among sites in the pre-COVID-19 vs. early-COVID-19 period Individuals in the early-COVID-19 period had higher odds of having ≥ 1 no-show [OR (95% CI): 1.27 (1.19, 1.35)] and lower odds of having high visit constancy [OR (95% CI): 0.85 (0.79, 0.92)] than the pre-COVID-19 period. The sensitivity analysis comparing no-shows categorized as ≤ 1 and ≥ 2, between pre-COVID-19 and early-COVID-19 period found no difference in the odds of having ≤ 1 vs. ≥2 no-shows [OR (95% CI): 1.03 (0.92, 1.14)]. Figure 2 shows the change in the proportion of individuals with high visit constancy and those with ≥ 1 no-shows in the pre-COVID-19 and early-COVID-19 period overall and for individual sites. Additionally, sensitivity analysis assessing visit constancy and no-shows excluding visits from Mar20 found that individuals in the early-COVID-19 period had higher odds of having ≥ 1 no-show [OR (95% CI): 1.29 (1.21, 1.38)] ; no differences in visit constancy [OR (95% CI): 0.96 (0.90, 1.03)] were observed (n = 6384). Moreover, analysis comparing no-shows and visit constancy among first and last six months of the early-COVID-19 period found that individuals in the second half of the early-COVID-19 period had lower odds of having ≥ 1 no-show [OR (95% CI): 0.91 (0.83, 0.99)] and higher odds of visit constancy than the first

Table II Logistic Regression Analysis Assessing Impact of Sociodemographics on No-show Primary Care Physician Visit

	Odds of having ≥ 1 vs. 0 No-show (n = 6,410)			
	PRE-COVID-19		EARLY-COVID-19	
Variables	OR (95% CI)	AOR (95% CI)	OR (95% CI)	AOR (95% CI)
Age	**0.97 (0.96, 0.97)**	**0.97 (0.97, 0.98)**	**0.97 (0.97, 0.98)**	**0.97 (0.97, 0.98)**
Income (units = 1000)	1.00 (1.00, 1.00)	0.99 (0.99, 1.00)	1.00 (1.00, 1.00)	1.00 (1.00, 1.00)
Gender				
Men	0.89 (0.79, 1.01)	1.06 (0.90, 1.25)	1.02 (0.91, 1.15)	1.13 (0.96, 1.32)
Transgender	**2.58 (1.32, 5.04)**	1.25 (0.61, 2.54)	1.77 (0.91, 3.47)	1.09 (0.53, 2.24)
Women	Reference	Reference	Reference	Reference
Race				
White	**0.58 (0.51, 0.66)**	**0.66 (0.58, 0.76)**	**0.69 (0.61, 0.77)**	**0.83 (0.73, 0.94)**
Other	**0.66 (0.44, 0.99)**	**0.60 (0.39, 0.91)**	0.78 (0.53, 1.14)	0.70 (0.47, 1.03)
Black	Reference	Reference	Reference	Reference
Housing Status				
Permanent/stable	**0.48 (0.39, 0.59)**	**0.48 (0.39, 0.60)**	**0.41 (0.34, 0.50)**	**0.45 (0.37, 0.56)**
Temporary/unstable	Reference	Reference	Reference	Reference
HIV Risk Factor				
MSM	0.95 (0.85, 1.06)	0.88 (0.75, 1.03)	0.99 (0.90, 1.11)	**0.82 (0.70, 0.95)**
Other	1.27 (0.99, 1.62)	1.00 (0.76, 1.32)	1.26 (0.99, 1.60)	1.06 (0.82, 1.37)
Heterosexual	Reference	Reference	Reference	Reference
Site				
7	**3.41 (2.72, 4.26)**	**3.33 (2.62, 4.23)**	**2.62 (2.10, 3.27)**	**2.36 (1.88, 2.97)**
6	**2.80 (2.05, 3.81)**	**2.13 (1.52, 2.98)**	1.29 (0.94, 1.76)	0.91 (0.65, 1.27)
5	**1.48 (1.28, 1.71)**	**1.55 (1.32, 1.81)**	1.06 (0.93, 1.22)	1.04 (0.90, 1.20)
4	1.01 (0.79, 1.29)	1.09 (0.84, 1.41)	**0.50 (0.39, 0.65)**	**0.49 (0.38, 0.63)**
3	**1.66 (1.39, 1.98)**	**1.87 (1.54, 2.28)**	**0.78 (0.65, 0.93)**	**0.74 (0.61, 0.89)**
2	**3.42 (2.56, 4.57)**	**2.36 (1.70, 3.26)**	**1.47 (1.10, 1.97)**	0.91 (0.66, 1.25)
1	Reference	Reference	Reference	Reference

[a]Bold denotes significance

[b]Transgender includes individuals transgender, unspecified transgender male-to-female, and transgender female-to-male

[c]Other race includes Asian, Native Hawaiian/Pacific Islander, American Indian or Alaska Native, and Other (including mixed race)

[d]Other risk factor includes Injection drug use (IDU), hemophilia/coagulation disorder, receipt of blood transfusion, blood components, or tissue, perinatal transmission, and MSM/IDU

half [OR (95% CI): 1.23 (1.09, 1.36)]. Sociodemographics in the early-COVID-19 vs. pre-COVID-19 period were found to be similar (supplementary table II).

No-show Dichotomous

When assessing the likelihood of an individual having ≥ 1 no-show in the pre-COVID-19 period (Table II), the adjusted multivariable analysis showed that PWH who were older [AOR (95% CI): 0.97 (0.97, 0.98)], White [AOR (95% CI): 0.66 (0.58, 0.76)] and "other" race [AOR (95% CI): 0.60 (0.39, 0.91)], and had permanent/stable housing [AOR (95% CI): 0.48 (0.39, 0.60)] had lower odds of having ≥ 1 no-show. For the early-COVID-19 period (Table II), the adjusted multivariable analysis showed that older PWH [AOR (95% CI): 0.97 (0.97, 0.98)] White [AOR (95% CI): 0.83 (0.73, 0.94)], PWH with permanent/stable housing [AOR (95% CI): 0.45 (0.37, 0.56)], and MSM [AOR (95% CI): 0.82 (0.70, 0.95)] had lower odds of having ≥ 1 no-show. When comparing the association between sociodemographics with no-show dichotomous categorized as ≥ 2 vs. ≤1 no-shows vs. ≥1 vs. 0 no-shows (supplementary table III), similar trends were observed, with the exception of the "other' race group vs. black having lower likelihood of having ≥ 1 no-shows in the pre-COVID-19 period [AOR (95% CI): 0.60 (0.39, 0.91)] and having lower likelihood of having ≥ 2 no-shows in the early-COVID period [AOR (95% CI): 0.42 (0.19, 0.91)].

Visit Constancy

Those more likely to attend ≥ 1 scheduled PCP visit during both 6-month intervals (high visit constancy) in the pre-COVID-19 period (Table III) were older [AOR (95% CI): 1.02 (1.01, 1.02)], had permanent/stable housing [AOR (95% CI): 1.75 (1.41, 2.75)], and were MSM [AOR (95% CI): 1.20 (1.03, 1.40)]. PWH more likely to attend ≥ 1 scheduled PCP visit during both 6-month intervals in the early-COVID-19 period (Table III) were older [AOR (95% CI): 1.02 (1.02, 1.03)], women [AOR (95% CI): 2.50 (1.20, 5.26)] "other" race category [AOR (95% CI): 1.80 (1.18, 2.75)], had permanent/stable housing [AOR (95% CI): 1.45 (1.17, 1.80)], MSM [AOR (95% CI): 1.20 (1.04, 1.40)], and "other" risk group PWH [AOR (95% CI): 1.50 (1.14, 1.98)].

Table III Logistic Regression Analysis Assessing Impact of Sociodemographics on Arrived Primary Care Physician Visit (6-month Visit Constancy)

	Odds of having High vs. Low Visit Constancy (n = 6,408)			
	PRE-COVID-19		EARLY-COVID-19	
Variables	OR (95% CI)	AOR (95% CI)	OR (95% CI)	AOR (95% CI)
Age	**1.02 (0.01, 1.02)**	**1.02 (1.01, 1.02)**	**1.02 (1.02, 1.03)**	**1.02 (1.02, 1.03)**
Income (units = 1000)	1.00 (1.00, 1.00)	1.00 (1.00, 1.00)	1.00 (1.00, 1.00)	1.00 (1.00, 1.00)
Gender				
Men	0.96 (0.85, 1.08)	0.90 (0.77, 1.06)	0.90 (0.81, 1.02)	0.89 (0.76, 1.04)
Transgender	0.56 (0.28, 1.10)	0.65 (0.31, 1.35)	**0.28 (0.14, 0.56)**	**0.40 (0.19, 0.83)**
Women	Reference	Reference	Reference	Reference
Race				
White	0.99 (0.88, 1.11)	0.97 (0.85, 1.10)	0.92 (0.82, 1.03)	0.90 (0.80, 1.02)
Other	1.29 (0.86, 1.92)	1.36 (0.90, 2.05)	**1.68 (1.11, 2.53)**	**1.80 (1.18, 2.75)**
Black	Reference	Reference	Reference	Reference
Housing Status				
Permanent/stable	**1.55 (1.26, 1.90)**	**1.75 (1.41, 2.75)**	**1.34 (1.09, 1.64)**	**1.45 (1.17, 1.80)**
Temporary/unstable	Reference	Reference	Reference	Reference
HIV Risk Factor				
MSM	1.02 (0.91, 1.13)	**1.20 (1.03, 1.40)**	0.94 (0.84, 1.04)	**1.20 (1.04, 1.40)**
Other	0.82 (0.64, 1.05)	0.87 (0.67, 1.13)	1.26 (0.98, 1.63)	**1.50 (1.14, 1.98)**
Heterosexual	Reference	Reference	Reference	Reference
Site				
7	**1.40 (1.05, 1.86)**	**1.55 (1.16, 2.07)**	0.83 (0.65, 1.06)	0.96 (0.75, 1.23)
6	1.23 (0.84, 1.80)	**1.56 (1.04, 2.32)**	1.06 (0.75, 1.51)	1.33 (0.92, 1.92)
5	**0.42 (0.37, 0.48)**	**0.41 (0.36, 0.48)**	**0.53 (0.47, 0.61)**	**0.54 (0.47, 0.62)**
4	**0.54 (0.44, 0.67)**	**0.54 (0.44, 0.68)**	**0.68 (0.55, 0.84)**	**0.71 (0.57, 0.88)**
3	**0.34 (0.29, 0.41)**	**0.36 (0.30, 0.43)**	**0.27 (0.23, 0.32)**	**0.30 (0.24, 0.34)**
2	0.74 (0.54, 1.02)	1.06 (0.75, 1.50)	0.85 (0.62, 1.16)	1.13 (0.80, 1.57)
1	Reference	Reference	Reference	Reference

[a]Bold denotes significance

[b]Transgender includes individuals transgender, unspecified transgender male-to-female, and transgender female-to-male

[c]Other race includes Asian, Native Hawaiian/Pacific Islander, American Indian or Alaska Native, and Other (including mixed race)

[d]Other risk factor includes Injection drug use (IDU), hemophilia/coagulation disorder, receipt of blood transfusion, blood components, or tissue, perinatal transmission, and MSM/IDU

Discussion

Findings from this study showed that compared to the pre-COVID-19 period, a larger number of HIV-related PCP visits were scheduled during the early-COVID-19 period. Additionally, the odds of no-show were greater and the rate of kept visits was lower in the early-COVID-19 period; this was accompanied by a higher rate of cancelled visits in the early-COVID-19 period. In line with this, a study conducted in Nashville, Tennessee, observed a reduction in the HIV-related medical encounters among retained PWH due to COVID-19 [21]. Moreover, our findings showed that despite the COVID-19 pandemic, most appointments were scheduled in-person, followed by telephone and video visits. When assessing the overall no-show rates for each visit type since March 2020, in-person visits had the highest no-show rate compared with telephone and video visits, which had comparable no-show rates. This may suggest that shifts to telehealth did not increase missed visits among PWH.

When focusing on the individual-level data, our findings suggest that PWH had a lower likelihood of attending ≥ 1 scheduled PCP in both 6-month intervals in the early-COVID-19 period compared to the pre-COVID-19 period. Additionally, individuals were more likely to miss visits in the early-COVID-19 than the pre-COVID-19 period. In line with this, a study conducted in Italy which compared HIV-related missed visits in a similar, but shorter pre-COVID-19 and early-COVID-19 time periods found that PWH missed more visits in the COVID-19 period [22]. We found higher no-shows and lower visit constancy after the emergence of COVID-19, demonstrating that PWH were more likely to miss and less likely to regularly attend regularly scheduled appointments during early-COVID-19. This may suggest that COVID-19 limited PWH's ability to maintain consistent HIV care over time during the first year of the pandemic.

There were some sociodemographic differences in retention in care prior to and during COVID-19 that varied by retention measures. For example, Black PWH as compared to the "other" race group were more likely to have ≥ 1 no-show in the pre-COVID-19 period only, whereas MSM compared to heterosexual were less likely to have ≥ 1 no-show in the early-COVID-19 period only. This pattern was also observed when assessing visit constancy. Cisgender women vs. transgender people, "other" race group compared to Black, and "other" HIV risk group vs. heterosexual contact had higher visit constancy in the early-COVID-19 period only. In line with our findings, an observational study conducted in Seattle reviewed trends in the visit type pre- and during COVID-19. The authors compared factors associated with attending video-based HIV primary care visits and

found that Black PWH were less likely than white PWH to attend a video visit during COVID [23]. Moreover, a study conducted in Italy comparing HIV retention in care trends in pre- and during COVID-19 found that women were more likely to miss their HIV appointments than men and had lower attendance during the COVID-19 period [22]. These dissimilar associations between patient factors and retention in care outcomes in the pre-COVID-19 vs. COVID-19 period suggest that certain groups were more impacted by the COVID-19 pandemic than others. One consistent theme was the importance of stable housing as this was associated with lower likelihood of missed visits and higher visit constancy across the pre-COVID-19 and early-COVID-19 periods.

As missed visits and kept visits capture unique behaviors related to retention in care in PWH, our study found some factors to be associated with either no-shows or visit constancy, but not both. As found in both pre-and early-COVID 19 periods, Black compared to White PWH were more likely to have a no-show but had similar visit constancy. MSM vs. heterosexual PWH had similar no-shows but higher visit constancy in the pre-COVID-period, while, in the early-COVID-19 period, transgender people vs. cisgender women and heterosexual vs. "other" HIV risk category had a lower visit constancy but similar no-show rates. These sociodemographic differences underscore that disparities among different groups of PWH remain, particularly for Black PWH, and highlight the need for interventions that target social determinants of health.

This difference in associations among missed-visit and kept-visit measures aligns with previous studies assessing retention in care, where one patient-related factor is not necessarily associated with both missed-visit and kept-visit outcomes. A study conducted among PWH that assessed the association of patient sociodemographics and clinical characteristics with retention in care found race to be associated with missed visits only and gender to be associated with kept visits only [24].

Strengths and Limitations

The data for this study was from seven sites across the state of Alabama, including the majority of Ryan White Clinics providing medical care to PWH in the state. Findings from these studies are representative of most of the PWH in medical care in Alabama, likely making the results generalizable to PWH statewide as well as PWH living in other states in the Deep South that have a similar population of PWH. Additionally, whereas previous analyses mostly assessed clinic-wide outcomes, our multi-site analysis, which longitudinally captured retention in care outcomes prior to and during COVID-19, examined individual-level outcomes.

There were some limitations associated with our study. Visit type (in person, video, telephone) was not captured thoroughly in the pre-COVID-19 period as the visits were predominantly in-person, limiting our ability to draw comparisons between visit type-related retention in HIV care trends prior to and during COVID-19. The lag between the data captured and the data available for analysis limited our ability to assess outcomes using the most up-to-date data, which may be different than those observed in this study reflective of the year preceding and following the onset of global COVID-19 pandemic in March 2020.

Conclusion

The findings from this study indicate that early-COVID-19 impacted retention in HIV primary care in a multi-site cohort of PLW spanning the Ending the HIV Epidemic-prioritized state of Alabama and adds to extant knowledge about the effect of the pandemic on this key HIV health outcome. Specifically, following the arrival of COVID-19, the likelihood of an individual attending ≥ 1 scheduled visit every six months was reduced and that of having more no-show visits was increased. Furthermore, certain sociodemographic groups seemed to be impacted notably by the pandemic as retention in care outcomes in these groups worsened during the pandemic, while stable housing was consistently associated with better retention across both outcome measures and both observation periods. Taken together, our study highlights important impacts of COVID-19 on ambulatory care patterns and retention among PWH, highlighting nuanced relationships between individual-level factors and retention in care as defined by missed and kept measures of retention, and over time during the year immediately preceding and following the declaration of the global COVID-19 pandemic in March 2020.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s10461-022-03886-0.

Author contribution Maira Sohail led study conception and design with consultation of Emma S. Kay and Michael Mugavero. Material preparation and analysis were performed by Maira Sohail. The first draft of the manuscript was written by Maira Sohail, and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Funding This study was a part of CDC PS18-1802 grant.

Data Availability Data supporting the findings of this study are available from the corresponding author on request.

Code Availability Code used for this studyis available from the corresponding author on request.

Declarations

Conflicts of Interest/Competing Interests The authors have no conflict of interest.

Ethics Approval This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Ethics Committee of the University of Alabama at Birmingham.

Consent to Participate Not applicable.

Consent for publication Not applicable.

References

1. World Health Organization. Coronavirus disease 2019 2020 [Available from: https://www.who.int/emergencies/diseases/novel-coronavirus-2019/events-as-they-happen.
2. Lau J, Knudsen J, Jackson H, Wallach AB, Bouton M, Natsui S, et al. Staying Connected In The COVID-19 Pandemic: Telehealth At The Largest Safety-Net System In The United States. Health Aff. 2020;39(8):1437–42.
3. Jiang H, Zhou Y, Tang W. Maintaining HIV care during the COVID-19 pandemic. Lancet HIV. 2020;7(5):e308-e9.
4. Shiau S, Krause KD, Valera P, Swaminathan S, Halkitis PN. The Burden of COVID-19 in People Living with HIV: A Syndemic Perspective. AIDS Behav. 2020;24(8):2244–9.
5. Fekete EM, Williams SL, Skinta MD. Internalised. HIV-stigma, loneliness, depressive symptoms and sleep quality in people living with HIV. Psychol Health. 2018;33(3):398–415.
6. Pantell M, Rehkopf D, Jutte D, Syme SL, Balmes J, Adler N. Social isolation: a predictor of mortality comparable to traditional clinical risk factors. Am J Public Health. 2013;103(11):2056–62.
7. Kawachi I, Berkman LF. Social ties and mental health. J Urban Health. 2001;78(3):458–67.
8. Taylor HO, Taylor RJ, Nguyen AW, Chatters L. Social Isolation, Depression, and Psychological Distress Among Older Adults. J Aging Health. 2016;30(2):229–46.
9. Zuniga JA, Yoo-Jeong M, Dai T, Guo Y, Waldrop-Valverde D. The Role of Depression in Retention in Care for Persons Living with HIV. AIDS Patient Care STDS. 2015;30(1):34–8.
10. Yehia BR, Stewart L, Momplaisir F, Mody A, Holtzman CW, Jacobs LM, et al. Barriers and facilitators to patient retention in HIV care. BMC Infect Dis. 2015;15(1):246.
11. Ridgway JP, Schmitt J, Friedman E, Taylor M, Devlin S, McNulty M, et al. HIV Care Continuum and COVID-19 Outcomes Among People Living with HIV During the COVID-19 Pandemic, Chicago, IL. AIDS Behav. 2020;24(10):2770–2.
12. Dandachi D, Dang BN, Lucari B, Teti M, Giordano TP. Exploring the Attitude of Patients with HIV About Using Telehealth for HIV Care. AIDS Patient Care STDS. 2020;34(4):166–72.
13. Dandachi D, Freytag J, Giordano TP, Dang BN. It is Time to Include Telehealth in Our Measure of Patient Retention in HIV Care. AIDS Behav. 2020.
14. Mugavero MJ, Westfall AO, Zinski A, Davila J, Drainoni M-L, Gardner LI, et al. Measuring retention in HIV care: the elusive gold standard. J Acquir Immune Defic Syndr. 2012;61(5):574–80.
15. Melnikow J, Kiefe C. Patient compliance and medical research: issues in methodology. J Gen Intern Med. 1994;9(2):96–105.
16. Mugavero MJ, Davila JA, Nevin CR, Giordano TP. From access to engagement: measuring retention in outpatient HIV clinical care. AIDS Patient Care STDS. 2010;24(10):607–13.
17. Spinelli MA, Hickey MD, Glidden DV, Nguyen JQ, Oskarsson JJ, Havlir D, et al. Viral suppression rates in a safety-net HIV clinic in San Francisco destabilized during COVID-19. AIDS (London, England). 2020;34(15).
18. El-Nahal WG, Shen NM, Keruly JC, Jones JL, Fojo AT, Lau B, et al. Telemedicine and visit completion among people with HIV during the coronavirus disease 2019 pandemic compared with prepandemic. Aids. 2022;36(3):355–62.
19. Sohail M, Rastegar J, Long D, Rana A, Levitan EB, Reed-Pickens H, et al Data for Care (D4C) Alabama: Clinic-Wide Risk Stratification With Enhanced Personal Contacts for Retention in HIV Care via the Alabama Quality Management Group. Journal of acquired immune deficiency syndromes (1999). 2019;82 Suppl 3:S192-s8.
20. SAS. SAS Software. Version 9.4. Cary. NC: SAS Institute Inc.; 2014.
21. Norwood J, Kheshti A, Shepherd BE, Rebeiro PF, Ahonkhai A, Kelly S, et al. The Impact of COVID-19 on the HIV Care Continuum in a Large Urban Southern Clinic. AIDS Behav. 2022:1–5.
22. Quiros-Roldan E, Magro P, Carriero C, Chiesa A, El Hamad I, Tratta E, et al. Consequences of the COVID-19 pandemic on the continuum of care in a cohort of people living with HIV followed in a single center of Northern Italy. AIDS Res Therapy. 2020;17(1):59.
23. Wood BR, Lan KF, Tao Y, Mose EY, Aas E, Budak JZ, et al. Visit Trends and Factors Associated With Telemedicine Uptake Among Persons With HIV During the COVID-19 Pandemic. Open Forum Infectious Diseases. 2021;8(11).
24. Batey DS, Kay ES, Westfall AO, Zinski A, Drainoni ML, Gardner LI, et al. Are missed- and kept-visit measures capturing different aspects of retention in HIV primary care? AIDS Care. 2020;32(1):98–103.