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Outcomes and Predictors of Rapid Antiretroviral Therapy Initiation for People With Newly Diagnosed HIV in an Integrated Health Care System

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Background. Rapid antiretroviral therapy (ART) is the recommended treatment strategy for patients newly diagnosed with HIV, but the literature supporting this strategy has focused on short-term outcomes. We examined both long-term outcomes and predictors of rapid ART among patients newly diagnosed with HIV within an integrated health care system in Northern California.

Methods. This observational cohort study included adults newly diagnosed with HIV between January 2015 and December 2020 at Kaiser Permanente Northern California. Rapid ART was defined as ART initiation within 7 days of HIV diagnosis. We collected demographic and clinical data to determine short-term and long-term outcomes, including viral suppression, care retention, medication adherence, and cumulative viral burden. Logistic regression models were used to identify predictors of rapid ART initiation.

Results. We enrolled 1409 adults; 34.1% initiated rapid ART. The rapid ART group achieved viral suppression faster (48 vs 77 days; $P < .001$) and experienced lower cumulative viral burden ($\log_{10}$ viremia copy-years, 3.63 vs 3.82; $P < .01$) but had slightly reduced medication adherence (74.8% vs 75.2%; $P < .01$). There was no improvement in long-term viral suppression and care retention in the rapid group during follow-up. Patients were more likely to initiate rapid ART after 2017 and were less likely if they required an interpreter.

Conclusions. Patients who received rapid ART had an improved cumulative HIV burden but no long-term improvement in care retention and viral suppression. Our findings suggest that rapid ART should be offered but additional interventions may be needed for patients newly diagnosed with HIV.

Keywords. HIV; rapid ART; retention in care.

Universal antiretroviral therapy (ART) is recommended for all people with HIV. Early initiation of ART has been associated with improved immune function, early viral suppression, and reduced AIDS-related and non-AIDS-related morbidity and mortality [1]. Before 2017, standard practice for people newly diagnosed with HIV was to allow time for baseline test result review, including HIV drug resistance testing, to help guide ART selection before medication initiation. In 2017, the World Health Organization (WHO) recommended rapid ART, defined as same-day treatment or treatment as soon as possible up to 7 days after diagnosis, as the initial treatment strategy for people newly diagnosed with HIV [2]. The adoption of rapid ART was based on several implementation studies in the United States and globally that demonstrated its efficacy, tolerability, and safety as an ART initiation strategy.

In 2013, rapid ART was piloted in a San Francisco safety-net clinic that demonstrated improved time to viral suppression, safety, and patient acceptability with rapid ART [3]. Subsequent implementation studies were conducted in Miami, New Orleans, Atlanta, and San Diego that demonstrated similar results. These initial studies found that rapid ART increased ART uptake, decreased time to viral suppression, and decreased time to HIV care linkage [4–7]. Rapid ART studies were also performed in Lesotho, South Africa, Haiti, and the United Kingdom and demonstrated reproducible results internationally [8–11]. While the outcomes of rapid ART in these early studies were favorable, the studies were limited by relatively small cohorts and limited study duration of up to 12 months. In the only long-term study to date, the Ward 86 RAPID ART program followed 225 patients for a median time of 1.09 years with a >90% viral suppression rate [12].

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Not all studies, however, were favorable—rapid ART programs in South Africa and Ethiopia showed increased loss to follow-up, reduced retention in care, and reduced viral suppression compared with standard of care [13–15]. Further investigation is needed on long-term care retention and viral suppression of the rapid ART strategy in other care settings and in larger, diverse cohorts.

It also remains unknown whether there are sociodemographic disparities or other important predictors of rapid ART initiation. Multiple city-wide HIV ART initiation studies in San Francisco found significant health disparities associated with early ART. The time from HIV diagnosis to viral suppression was longer among African Americans and people who inject drugs, and the lowest prevalence of rapid ART occurred in transgender women and persons reporting homelessness [16, 17]. The rapid ART model also does not address factors such as HIV stigma, medical mistrust, or inequitable care for vulnerable populations [18]. Further studies examining predictors of ART initiation are needed.

Rapid ART is the recommended ART initiation strategy for patients newly diagnosed with HIV, but the literature on this strategy has examined short-term outcomes with limited cohort sizes [4–11]. More data are needed to evaluate the effectiveness of rapid ART as an ART initiation strategy over a longer period. Data on sociodemographic predictors that may impact rapid ART initiation are also lacking. In this study, we investigated both long-term outcomes and predictors of rapid ART among patients newly diagnosed with HIV within an integrated health care system in Northern California.

METHODS

Study Design, Setting, and Population

This observational, longitudinal cohort study included members of Kaiser Permanente Northern California (KPNC), an integrated health care system in the United States, that provides comprehensive medical care, laboratory testing, and pharmacy services to >4 million patients. Within KPNC, there are 6 different service areas that include urban, suburban, and rural populations that are demographically similar to the insured adult population within its geographic region [19].

Patients in this study included adults (aged ≥18 years) who were newly diagnosed with HIV between January 1, 2015, and December 31, 2020. Chart review of KPNC's electronic medical record (EMR) was used to confirm all patients with new diagnoses of HIV, including date of diagnosis. Patients were included if they had sufficient KPNC insurance, defined as ≥9 months of membership within the first year following HIV diagnosis. Patients were excluded if they were previously diagnosed with HIV outside of KPNC or had any pregnancy during the study, as patients who were pregnant were referred to services outside of HIV care that had the potential to affect study outcomes. All patients with newly diagnosed HIV were referred to HIV care and provided with evidence-based HIV care services. Patients received care within their residing service area, which included dedicated clinician support, case management, and benefits coordination. Rapid ART was available at KPNC in 2015 and provided to patients based on local provider practices and available resources. Rapid ART initiation was defined as an ART prescription fill from a KPNC pharmacy within 7 days of HIV diagnosis. This study was granted exempt status by the KPNC Institutional Review Board.

Data Collection

Demographic and clinical data were obtained from KPNC's EMR and linked laboratory and pharmacy databases. Patients were included at baseline, defined as the date of HIV diagnosis. Longitudinal patient data were collected from baseline until December 31, 2021, death, or loss of KPNC membership (defined as a >90-day gap in health plan membership). Baseline HIV viral load and CD4 cell count were defined as the first measurement taken within 3 months of the date of HIV diagnosis. History of hepatitis B and C infection was determined based on the patient's historical laboratory data. Additional clinical data and International Classification of Diseases, Ninth Revision (ICD-9) and Tenth Revision (ICD-10), codes were collected from the EMR, which included history of mental health disorder (based on ICD-9 codes 296.x, 300.x–301.x, 309.x, 311.x and ICD-10 codes F30.x–F34.x, F40.x–F43.x), or ever having a Patient Health Questionnaire–9 (PHQ-9) score ≥10; and history of substance use disorder (based on ICD-9 codes 291.x–292.x, 303.x–305.x and ICD-10 codes F10.x–F16.x, F18.x–F19.x). The Deyo adaptation of the Charlson Comorbidity Index (CCI) scores was used to estimate comorbidity. CCI scores were calculated using inpatient and ambulatory diagnosis and procedure records in the EMR and categorized as (1) CCI score of 0, (2) CCI score of 1, or (3) CCI score of ≥2 [20, 21].

Outcomes

Short-term outcomes included the proportion of patients who achieve HIV viral suppression (HIV viral load <200 copies/mL) within 1 year of diagnosis and days from HIV diagnosis to laboratory-confirmed HIV viral suppression.

Long-term outcome measures included medication adherence, measured as the proportion of patients covered by ART medication ≥80% (defined as patients who had ART medication dispensed at a KPNC pharmacy that covered ≥80% of their follow-up period) and viremia copy-years (VCY; defined as the number of copies of HIV RNA per mL of plasma over time). Overall VCY was calculated using the trapezoidal rule as described in prior published studies [22, 23]. Viral load measurements were carried forward for up to 6 months unless another viral load measurement occurred first.

The proportion of patients who were virally suppressed and retained in care was calculated for each year of available follow-up starting from each patient's HIV diagnosis date. For viral suppression, patients were included in the denominator if they had ≥9 months of KPNC membership within that year of follow-up. Patients were included in the numerator if they had a HIV viral load result of <200 copies/mL within that year of follow-up. For care retention, patients were included in the denominator if they had ≥9 months of KPNC membership and if they had either an HIV viral load or an HIV specialist visit in that year of follow-up. Patients were included in the numerator if they had ≥2 HIV medical care encounters separated by 90 days where ≥1 encounter was with an HIV specialist and the other was an HIV specialist visit, HIV viral load, or adult/family medicine scheduled visit within that year of follow-up. The retained-in-care definition mirrors the definition used by the HIV/AIDS Bureau of the US Health Resources Services Administration [24].

Statistical Analysis

We compared patients who started ART within 7 days of diagnosis with patients who started ART >7 days after HIV diagnosis. Differences between groups were assessed using the Student *t* test for continuous values and chi-square test or Fisher exact test for categorical variables.

Logistic regression models were used to identify predictors of rapid ART initiation. Potential predictors included demographic variables, service area where HIV was diagnosed, primary language, need for interpreter, neighborhood deprivation index quartile, sexual orientation, mode of transmission, insurance type, CCI, history of hepatitis B virus or hepatitis C virus, history of mental health disorder or PHQ-9 ≥10, history of substance use disorder, and timing of HIV diagnosis relative to the 2017 WHO rapid ART recommendation. Predictors with *P* values <.20 in univariable logistic regression models were initially included in the multivariable model and then removed via backward selection. The final multivariable logistic regression model included terms for age, sex, race/ethnicity, need for interpreter, CCI, timing of HIV diagnosis relative to the 2017 WHO guidelines, and service area. Analyses were performed using SAS 9.4 (SAS Institute Inc, Cary, NC, USA).

RESULTS

We identified 1726 patients newly diagnosed with HIV from January 2015 to December 2020. We excluded 294 patients due to insufficient membership and 23 patients who were pregnant during the study. We enrolled 1409 patients in the study. Overall, the mean age (SD) was 37.3 (13.0) years, 89.1% were male, 20.7% identified as Black/African American, and 74.3% were men who have sex with men. Overall, 34.1% of patients with newly diagnosed HIV were started on rapid ART. Demographic characteristics were similar between the rapid and standard ART groups. Patients in the rapid ART group had a slightly higher mean age (38.3 years vs 36.8 years; $P < .05$) and had fewer cases of viral hepatitis compared with the standard group (0.8% vs 2.6%; $P < .05$). There were no differences in the median baseline HIV viral load or CD4 count, but there were differences in the baseline HIV viral load and CD4 count categories (Table 1).

Within 1 year of HIV diagnosis, most patients had achieved HIV viral suppression (89.8% rapid vs 91.6% standard; $P = .09$). The average length of time to viral suppression was 48 days in the rapid group and 77 days in the standard group ($P < .001$). There were missing data on 65 patients (4.6%) (Table 2).

The overall mean duration of follow-up (SD) was 3.3 (1.8) years, with a mean of 3.5 (1.8) years in the standard ART group and 2.8 (1.6) years in the rapid ART group. Patients had between 1 and 6 years of follow-up. Fewer patients in the rapid ART group met criteria for proportion of days covered with ART medication >80% compared with the standard ART group (74.8% vs 75.2%; $P < .001$). Those in the rapid ART group had lower cumulative viral exposure over the duration of the study compared with the rapid ART group ($\log_{10}$ VCY, 3.63 vs 3.82; $P < .01$).

Over the follow-up period, viral suppression in the standard ART group remained above 80%, whereas viral suppression dropped below 80% for the rapid ART group at years 3 and 4 of follow-up. There were no statistically significant differences aside from year 3 of follow-up (79.6% vs 86.7%; $P = .02$) (Figure 1). Retention in care peaked on year 1 and reduced with every subsequent year of follow-up for both groups. There were no statistically significant differences noted (Figure 2).

No significant differences in the unadjusted odds ratio (OR) of starting rapid ART were found for sex, age, or race/ethnicity compared with the reference groups (Table 3). The odds of starting rapid ART were lower if patients required an interpreter and higher if the patient's HIV diagnosis occurred after June 30, 2017. Odds of starting rapid ART varied by KPNC service area, with West Bay being more likely and Diablo/Napa Solano and Fresno/Central California being less likely, with East Bay/Greater Southern Alameda County as the reference. After adjusting for demographic variables, interpreter need, comorbidity index, timing of HIV diagnosis, and diagnosing service area, no significant changes were found except for a lower odd of rapid ART for patients with a higher CCI (adjusted odds ratio [aOR], 0.65; $P < .05$) and if diagnosis occurred in Sacramento Valley (aOR, 0.66; $P < .05$).

DISCUSSION

In this large, diverse cohort with longitudinal follow-up, patients newly diagnosed with HIV who received rapid ART as

Table 1. Demographic and Clinical Characteristics of People With Newly Diagnosed HIV at Kaiser Permanente Northern California, 2015–2020

Characteristics	Overall (n = 1409)	Standard ART (n = 928)	Rapid ART (n = 481)	*P* Value[a]
Demographics				
Age				
Mean (SD), y	37.3 (13.0)	36.8 (13.1)	38.3 (12.7)	<.05
Age group				.32
18–34 y	700 (49.7)	473 (51.0)	227 (47.2)	
35–49 y	415 (29.5)	265 (28.6)	150 (31.2)	
50–64 y	259 (18.4)	164 (17.7)	95 (19.8)	
≥65 y	35 (2.5)	26 (2.8)	9 (1.9)	
Sex				.73
Female	123 (8.7)	84 (9.1)	39 (8.1)	
Male	1255 (89.1)	825 (88.9)	430 (89.4)	
Transgender	31 (2.2)	19 (2.0)	12 (2.5)	
Race/ethnicity				.09
Asian/Pacific Islander	194 (13.8)	133 (14.3)	61 (12.7)	
Black/African American	292 (20.7)	200 (21.6)	92 (19.1)	
Hispanic/Latino	421 (29.9)	287 (30.9)	134 (27.9)	
White	431 (30.6)	268 (28.9)	163 (33.9)	
Other/unknown	71 (5.0)	40 (4.3)	31 (6.4)	
Diagnosing service area				<.001
Peninsula South Bay	264 (18.7)	171 (18.4)	93 (19.3)	
West Bay	270 (19.2)	127 (13.7)	143 (29.7)	
Sacramento Valley	256 (18.2)	185 (19.9)	71 (14.8)	
Diablo Napa Solano	172 (12.2)	139 (15.0)	33 (6.9)	
East Bay GSAA	299 (21.2)	193 (20.8)	106 (22.0)	
Fresno Central Cal	148 (10.5)	113 (12.2)	35 (7.3)	
Non-English primary language	105 (7.5)	75 (8.1)	30 (6.2)	.21
Needs interpreter				<.01
Needs interpreter	43 (3.1)	38 (4.1)	5 (1.0)	
Does not need interpreter	1366 (96.9)	890 (95.9)	476 (99.0)	
Risk groups				
MSM	1047 (74.3)	689 (74.2)	358 (74.4)	.94
Heterosexual	346 (24.6)	235 (25.3)	111 (23.1)	.35
Intravenous drug use	65 (4.6)	45 (4.8)	20 (4.2)	.56
Insurance				
Commercial	1322 (93.8)	870 (93.8)	452 (94.0)	.87
Noncommercial	157 (11.1)	103 (11.1)	54 (11.2)	.94
Comorbidities				
Charlson Comorbidity Index				.23
0	1170 (83.0)	761 (82.0)	409 (85.0)	
1	144 (10.2)	104 (11.2)	40 (8.3)	
≥2	95 (6.7)	63 (6.8)	32 (6.7)	
History of HBV/HCV	28 (2.0)	24 (2.6)	4 (0.8)	<.05
History of mental health disorder or PHQ-9 ≥10	267 (18.9)	180 (19.4)	87 (18.1)	.55
History of substance use disorder	113 (8.0)	74 (8.0)	39 (8.1)	.93
HIV care				
Diagnosis after WHO guidelines	817 (58.0)	460 (49.6)	357 (74.2)	<.001
Baseline HIV VL, median (IQR)	63 619 (14 641–283 000)	63 300 (17 500–237 824)	65 311 (7713–377 664)	.75
Baseline HIV VL category				<.001
<200	83 (5.9)	30 (3.2)	53 (11.0)	
200–100 000	683 (48.5)	505 (54.4)	178 (37.0)	
>100 000	535 (38.0)	346 (37.3)	189 (39.3)	
Missing	108 (7.7)	47 (5.1)	61 (12.7)	
Baseline CD4, median (IQR)	408 (229–580)	406 (245–574)	417 (210–594)	.98
Baseline CD4 category				<.001
<200	281 (19.9)	178 (19.2)	103 (21.4)	

Table 1. Continued

Characteristics	Overall (n = 1409)	Standard ART (n = 928)	Rapid ART (n = 481)	*P* Value[a]
200–500	545 (38.7)	387 (41.7)	158 (32.8)	
>500	476 (33.8)	314 (33.8)	162 (33.7)	
Missing	107 (7.6)	49 (5.3)	58 (12.1)	

Results are presented as No. (%) unless otherwise noted.

Abbreviations: ART, antiretroviral therapy; HBV/HCV, hepatitis B/C virus; IQR, interquartile range; MSM, men who have sex with men; PHQ-9, Patient Health Questionnaire–9; VL, viral load; WHO, World Health Organization.

[a]*P* value for the chi-square test of association or Fisher exact test for categorical variables and Kruskall-Wallis test for continuous variables.

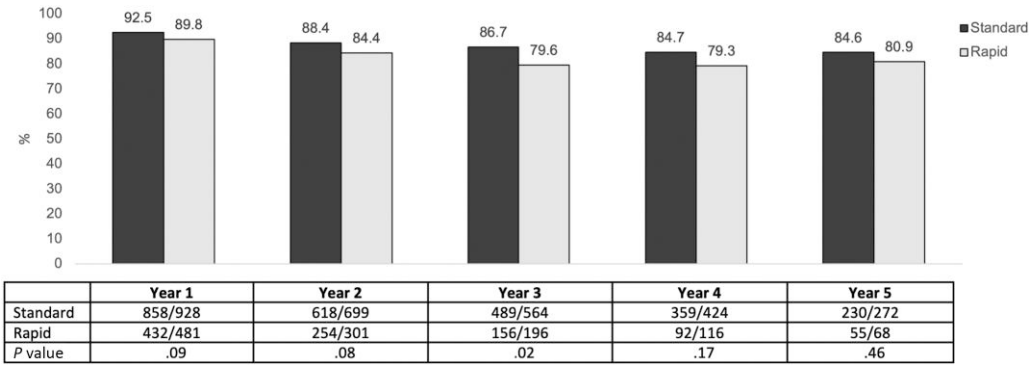
Table 2. One-year and Long-term Outcomes of Standard vs Rapid ART

Outcomes	Overall (n = 1409)	Standard ART (n = 928)	Rapid ART (n = 481)	*P* Value[a]
One-year outcomes				
Achieved VL <200 copies	1290 (91.6)	858 (92.5)	432 (89.8)	.09
Days to VL <200 copies				
Median (IQR)	69.0 (45.0–109.5)	77.0 (54.0–119.0)	48.0 (34.0–89.0)	<.001
Missing, No. (%)	65 (4.6)	33 (3.6)	32 (6.7)	
Long-term outcomes				
Medication adherence ≥80%	1058 (75.1)	698 (75.2)	360 (74.8)	<.001
Viremia copy-years				
Median (IQR)	6104 (1367–26 193)	6605 (1751–27 446)	4309 (585–23 284)	<.01
Missing, No. (%)	137 (9.7)	68 (7.3)	69 (14.3)	
Log_{10} viremia copy-years				
Median (IQR)	3.79 (3.14–4.42)	3.82 (3.24–4.44)	3.63 (2.77–4.37)	<.01
Missing, No. (%)	137 (9.7)	68 (7.3)	69 (14.3)	

Results are presented as No. (%) unless otherwise noted.

Abbreviations: ART, antiretroviral therapy; IQR, interquartile range; VL, viral load.

[a]*P* value for the chi-square test of association or Fisher exact test for categorical variables and Kruskall-Wallis test for continuous variables.

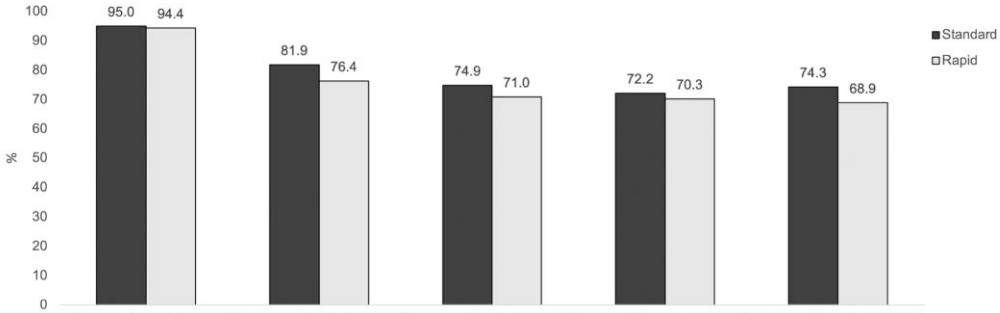


	Year 1	Year 2	Year 3	Year 4	Year 5
Standard	858/928	618/699	489/564	359/424	230/272
Rapid	432/481	254/301	156/196	92/116	55/68
P value	.09	.08	.02	.17	.46

Figure 1. Proportion of patients with HIV VL <200 during the follow-up year, 2015–2020. Abbreviation: VL, viral load.

an initiation strategy achieved viral suppression in fewer days and experienced reduced cumulative viral exposure. However, the rapid ART strategy resulted in slightly lower medication adherence and no significant improvement in long-term viral suppression and care retention. Our study demonstrates mixed outcomes compared with prior US-based and international studies showing improved linkage to care and care retention with the rapid ART initiation strategy [25].

The reasons for these mixed outcomes in care retention and medication adherence are unclear. It was expected that patients who were rapidly started on ART and linked to care would be more likely to remain retained in care and have improved



	Year 1	Year 2	Year 3	Year 4	Year 5
Standard	877/923	535/653	400/534	285/395	185/249
Rapid	434/460	207/271	125/176	71/101	42/61
P value	.60	.05	.31	.71	.39

Figure 2. Proportion retained in care during the follow-up year, 2015–2020.

medication adherence. We suspect that the lower medication adherence may occur due to multiple factors like lack of time to adjust to HIV diagnosis or inadequately addressing structural barriers like cost of ART. It is possible that providing rapid linkage to care after HIV diagnosis may have led to reduced need for follow-up visits as patients achieved viral suppression quicker, resulting in lower care retention. Another reason for this observation is that the rapid ART strategy may not provide enough time to address HIV stigma, social determinants of health, and medical mistrust, leading to loss to follow-up and lower medication adherence. This was observed in a qualitative study on the rapid ART strategy in San Francisco, which showed high acceptability but found that some patients hesitated to undergo rapid ART due to complex psychosocial and structural challenges [26]. Studies in South Africa, Ethiopia, and a large program in Sub-Saharan Africa have also shown that same-day ART initiation resulted in more loss to follow-up [13–15, 27]. These studies suggest that rapid ART may not be an ideal strategy for every person, and our study supports these findings. Further studies are needed to address potential psychosocial or structural barriers to ART initiation.

Our study's short-term outcomes were promising for the rapid ART strategy and were consistent with prior studies. However, long-term follow-up demonstrated no improvement in viral suppression or care retention, as seen in Figures 1 and 2. Viral suppression rates were highest in the first year of follow-up but dropped in the following years. Notably, viral suppression dropped to below 80% in the rapid ART group in years 3 and 4 of follow-up, with a statistically significant difference in year 3. Care retention was comparable and highest in year 1 for both groups. However, by the third year of follow-up, care retention fell below 80% for both groups. This is lower than the average care retention (79%–81%) seen from Ryan White Clinics data from 2016 to 2020 [28]. As patients were more likely to start rapid ART after 2017, data on the rapid ART cohort were limited, with a shorter follow-up, which may have affected our data in terms of detecting significant differences. However, the follow-up data demonstrate that the rapid ART strategy did not improve long-term viral suppression or retention in care rates seen in prior studies that examined short-term outcomes. These data highlight areas for further research on barriers to care engagement and retention.

Fortunately, our study's outcome of reduced cumulative viral exposure is promising. Multiple studies have recently highlighted that lower cumulative viral exposure has been associated with improved mortality, multimorbidity, cardiovascular disease, and diabetes [23, 29–31]. These studies suggest that lowering viral exposure over time can significantly reduce non-AIDS-related morbidity and mortality, and rapid ART strategies may support this aim. In our study, there were no significant differences in the baseline HIV viral load, and overall viral suppression during follow-up in the rapid ART group was slightly lower compared with the standard group. Despite these findings, cumulative viral exposure remained lower in the rapid ART group. This suggests that rapid ART may reduce HIV burden immediately after diagnosis, which can further reduce cumulative viral burden.

Finally, in our multivariable logistic regression analysis, we found no significant demographic variables that increased or lowered the odds of rapid ART. Our analysis did identify a significant reduction in rapid ART if there were language barriers requiring an interpreter, certain comorbidities, and if diagnosis occurred in certain service areas. Additional research on identifying other socioeconomic barriers to rapid ART not reflected in our data could be helpful.

Our study reflects a real-world implementation of the WHO's rapid ART guidelines in a US-based, integrated health system. It is limited to KPNC patients, who are insured and may not represent the most vulnerable patients socioeconomically impacted by HIV. However, our cohort includes patients

Table 3. Odds of Rapid ART Initiation Among Patients With Newly Diagnosed HIV at KPNC, 2015–2020

Variables	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
Sex		
Male	1.00	1.00
Female	0.89 (0.60–1.33)	1.07 (0.69–1.66)
Transgender	1.21 (0.58–2.52)	1.11 (0.50–2.49)
Age		
18–34 y	1.00	1.00
35–49 y	1.18 (0.91–1.52)	1.15 (0.87–1.53)
50–64 y	1.21 (0.90–1.63)	1.23 (0.87–1.74)
≥65 y	0.72 (0.33–1.56)	0.90 (0.38–2.15)
Race/ethnicity		
White	1.00	1.00
Asian/Pacific Islander	0.75 (0.53–1.08)	0.71 (0.48–1.04)
Black/African American	0.76 (0.55–1.04)	0.77 (0.54–1.11)
Hispanic/Latino	0.77 (0.58–1.02)	0.84 (0.61–1.15)
Other/unknown	1.27 (0.77–2.12)	1.40 (0.81–2.42)
Need for interpreter		
No	1.00	1.00
Yes	0.25 (0.10–0.63)**	0.23 (0.08–0.61)**
Charlson Comorbidity Index		
0	1.00	1.00
1	0.72 (0.49–1.05)	0.65 (0.43–0.98)*
≥2	0.95 (0.61–1.47)	0.83 (0.50–1.38)
Time of HIV diagnosis		
January 2015–June 2017	1.00	1.00
July 2017–December 2020	2.93 (2.30–3.73)***	3.62 (2.79–4.70)***
KPNC service area		
East Bay/Greater Southern Alameda County	1.00	1.00
Diablo/Napa Solano	0.43 (0.28–0.68)***	0.33 (0.21–0.53)***
Fresno/Central California	0.56 (0.36–0.88)*	0.45 (0.28–0.72)***
Peninsula/South Bay	0.99 (0.70–1.40)	0.90 (0.62–1.31)
Sacramento Valley	0.70 (0.49–1.00)	0.66 (0.45–0.97)*
West Bay	2.05 (1.46–2.87)***	2.16 (1.49–3.13)***

Multivariable logistic regression model adjusted for sex, age, race/ethnicity, need for interpreter, Charlson Comorbidity Index, timing of HIV diagnosis relative to WHO guidelines, and KPNC service area.

Abbreviations: ART, antiretroviral therapy; KPNC, Kaiser Permanente Northern California; OR, odds ratio; WHO, World Health Organization.

*$P < .05$; **$P < .01$; ***$P < .001$.

with subsidized insurance plans like Medicare and Medicaid and represents a demographically diverse population that continues to be affected by new HIV diagnoses, similar to national trends [32]. Another limitation of our study is that a portion of the follow-up period occurred during the COVID-19 pandemic, which may have affected laboratory data, follow-up visits, and missing data. However, in a separate analysis of this study, no statistically significant differences were found in care delivery in our cohort before or during the COVID-19 pandemic [33]. Finally, there were missing data on viral load measurements for 9.7% of patients, which may have introduced bias into the analysis of cumulative viremic burden. As seen in prior literature and in this study, missing data mostly came from patients who started rapid ART, likely due to higher loss to follow-up and delayed HIV viral load and CD4 cell count monitoring [13–15, 27]. However, we did not detect statistically significant differences in the distribution of baseline HIV viral load or CD4 cell count.

In summary, we found that patients newly diagnosed with HIV in an integrated health care system, like KPNC, who received rapid ART initiation had improved cumulative HIV exposure but no improvement in long-term trends in viral suppression, care retention, or medication adherence. These data suggest that rapid ART should be offered, but additional interventions to improve long-term viral suppression and care retention may be needed for patients newly diagnosed with HIV. Further studies are needed to evaluate if similar long-term outcomes are seen in other health care settings to evaluate the advantages and disadvantages of a universal rapid ART strategy.

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Author contributions. A.D. and E.C. assisted with data analysis and manuscript writing. Z.S. assisted with study design, data collection, data analysis, and manuscript writing. C.L. helped with study design, data analysis, and manuscript writing. J.O.L. assisted with study design and data analysis. M.N.L. provided project supervision, data analysis, and manuscript writing and editing.

Patient consent. This study did not include factors necessitating patient consent and was granted exempt status by the KPNC Institutional Review Board.

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References

1. INSIGHT START Study Group, Lundgren JD, Babiker AG, et al. Initiation of antiretroviral therapy in early asymptomatic HIV infection. N Engl J Med **2015**; 373: 795–807.
2. World Health Organization. Guidelines for Managing Advanced HIV Disease and Rapid Initiation of Antiretroviral Therapy. World Health Organization; **2017**.
3. Pilcher CD, Ospina-Norvell C, Dasgupta A, et al. The effect of same-day observed initiation of antiretroviral therapy on HIV viral load and treatment outcomes in a US public health setting. J Acquir Immune Defic Syndr **2017**; 74:44–51.
4. Hoenigl M, Chaillon A, Moore DJ, et al. Rapid HIV viral load suppression in those initiating antiretroviral therapy at first visit after HIV diagnosis. Sci Rep **2016**; 6: 32947.
5. Colasanti J, Sumitani J, Mehta CC, et al. Implementation of a rapid entry program decreases time to viral suppression among vulnerable persons living with HIV in the Southern United States. Open Forum Infect Dis **2018**; 5:XXX–XX.
6. Halperin J, Conner K, Butler I, et al. A care continuum of immediate ART for newly diagnosed patients and patients presenting later to care at a federally qualified health center in New Orleans. Open Forum Infect Dis **2019**; 6:XXX–XX.
7. Rodriguez AE, Wawrzyniak AJ, Tookes HE, et al. Implementation of an immediate HIV treatment initiation program in a public/academic medical center in the U. S. South: the Miami Test and Treat Rapid Response Program. AIDS Behav **2019**; 23(Suppl 3):287–95.
8. Labhardt ND, Ringera I, Lejone TI, et al. Effect of offering same-day ART vs usual health facility referral during home-based HIV testing on linkage to care and viral suppression among adults with HIV in Lesotho: the CASCADE randomized clinical trial. JAMA **2018**; 319:1103–12.

9. Rosen S, Maskew M, Fox MP, et al. Initiating antiretroviral therapy for HIV at a patient's first clinic visit: the RapIT randomized controlled trial. PLoS Med **2016**; 13:e1002015.
10. Koenig SP, Dorvil N, Dévieux JG, et al. Same-day HIV testing with initiation of antiretroviral therapy versus standard care for persons living with HIV: a randomized unblinded trial. PLoS Med **2017**; 14:e1002357.
11. Girometti N, Nwokolo N, McOwan A, Whitlock G. Outcomes of acutely HIV-1-infected individuals following rapid antiretroviral therapy initiation. Antivir Ther **2017**; 22:77–80.
12. Coffey S, Bacchetti P, Sachdev D, et al. Rapid antiretroviral therapy: high virologic suppression rates with immediate antiretroviral therapy initiation in a vulnerable urban clinic population [published correction appears in AIDS 2019; 33:2113]. AIDS **2019**; 33:825–32.
13. Joseph Davey D, Kehoe K, Serrao C, et al. Same-day antiretroviral therapy is associated with increased loss to follow-up in South African public health facilities: a prospective cohort study of patients diagnosed with HIV. J Int AIDS Soc **2020**; 23: e25529.
14. Ahmed I, Demissie M, Worku A, Gugsa S, Berhane Y. Effectiveness of same-day antiretroviral therapy initiation in retention outcomes among people living with human immunodeficiency virus in Ethiopia: empirical evidence. BMC Public Health **2020**; 20:1802.
15. Ahmed I, Demissie M, Worku A, Gugsa S, Berhane Y. Virologic outcomes of people living with human immunodeficiency virus who started antiretroviral treatment on the same-day of diagnosis in Ethiopia: a multicenter observational study. PLoS One **2021**; 16:e0257059.
16. Hsu LC, Truong HM, Vittinghoff E, Zhi Q, Scheer S, Schwarcz S. Trends in early initiation of antiretroviral therapy and characteristics of persons with HIV initiating therapy in San Francisco, 2007-2011. J Infect Dis **2014**; 209:1310–4.
17. Bacon O, Chin J, Cohen SE, et al. Decreased time from HIV diagnosis to care, ART initiation, and virologic suppression during the citywide RAPID initiative in San Francisco. Clin Infect Dis **2021**; 73:e122–8.
18. Mgbako O, Sobieszczyk M E, Olender S, et al. Immediate antiretroviral therapy: the need for a health equity approach. Int J Environ Res Public Health **2020**; 17: 7345.
19. Gordon NP. Similarity of adult Kaiser Permanente members to the adult population in Kaiser Permanente's Northern California service area: Comparisons based on the 2017/2018 cycle of the California Health Interview Survey. **2020**. Available at: https://memberhealthsurvey.kaiser.org/Documents/compare_kp_ncal_chis2017-18.pdf. Accessed April 19, 2023.
20. Deyo RA, Cherkin DC, Ciol MA. Adapting a clinical comorbidity index for use with ICD-9-CM administrative databases. J Clin Epidemiol **1992**; 45:613–9.
21. Sundararajan V, Henderson T, Perry C, Muggivan A, Quan H, Ghali WA. New ICD-10 version of the Charlson Comorbidity Index predicted in-hospital mortality. J Clin Epidemiol **2004**; 57:1288.
22. Cole SR, Napravnik S, Mugavero MJ, Lau B, Eron JJ, Saag MS. Copy-years viremia as a measure of cumulative human immunodeficiency virus viral burden. Am J Epidemiol **2010**; 171:198–205.
23. Mugavero MJ, Napravnik S, Cole SR, et al. Viremia copy-years predicts mortality among treatment-naive HIV-infected patients initiating antiretroviral therapy. Clin Infect Dis **2011**; 53:927–35.
24. Health Resources Services Administration (HRSA). HIV/AIDS Bureau performance measure portfolio. Performance measure: annual retention in care. Available at: https://ryanwhite.hrsa.gov/grants/performance-measure-portfolio. April 19, 2023.
25. Mateo-Urdiales A, Johnson S, Smith R, Nachega JB, Eshun-Wilson I. Rapid initiation of antiretroviral therapy for people living with HIV. Cochrane Database Syst Rev **2019**; 6:CD012962.
26. Christopoulos KA, Erguera XA, VanderZanden L, et al. A qualitative study of the experience of immediate antiretroviral therapy among urban persons with newly diagnosed human immunodeficiency virus. Open Forum Infect Dis **2021**; 8:XXX–XX.
27. Ross J, Brazier E, Fatti G, et al. Same-day antiretroviral therapy initiation as a predictor of loss to follow-up and viral suppression among people with human immunodeficiency virus in Sub-Saharan Africa. Clin Infect Dis **2023**; 76:39–47.
28. Health Resources and Services Administration. Ryan White HIV/AIDS Program annual client-level data report 2020. Available at: https://ryanwhite.hrsa.gov/data/reports. Published December 2021.
29. Morton ZP, Mehta CC, Wang T, et al. Cumulative HIV-1 viremia is associated with increased risk of multimorbidity among U.S. women living with HIV, 1997-2019. Open Forum Infect Dis **2022**; 10.
30. Elvstam O, Marrone G, Engström G, et al. Associations between HIV viremia during antiretroviral therapy and cardiovascular disease. AIDS **2022**; 36:1829–34.
31. Rivera AS, Rusie L, Plank M, et al. Association of cumulative viral load with the incidence of hypertension and diabetes in people with HIV. Hypertension **2022**; 79:e135–42.
32. Centers for Disease Control and Prevention. HIV surveillance report, 2020; vol. 33. **2022**. Available at: https://www.cdc.gov/hiv/library/reports/hiv-surveillance.html. Accessed June 19, 2022.
33. Mohr KB, Lee-Rodriguez C, Samiezade-Yazd Z, Lam JO, Imp BM, Luu MN. Impact of the coronavirus disease 2019 pandemic on antiretroviral therapy initiation and care delivery for people with newly diagnosed HIV in an integrated healthcare system. Open Forum Infect Dis **2022**; 9:XXX–XX.