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Original article

Impact of same-day ART initiation on medical care and medication discontinuation among patients with incident HIV infection or AIDS in Taiwan: A population-based cohort study

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ABSTRACT

Background: Care retention and medication adherence are crucial for individuals living with human immunodeficiency virus (HIV). Discrepancies exist between real-world evidence and randomized trials regarding early antiretroviral therapy (ART) initiation and care retention. We investigated the effects of same-day ART initiation on care and medication discontinuation in new patients with acquired immunodeficiency syndrome (AIDS) and those newly infected with HIV.

Methods: The two groups commenced ART from January 2017 to December 2021 in Taiwan. Data were collected from the National Health Insurance claims database. We defined care discontinuation as having no clinical visits for over 90 days since the last clinical visit and medication discontinuation as failing to pick up medication 30 days after the expected medication pick-up date. We used a doubly robust weighted Cox regression model to estimate the average hazard ratio for same-day ART initiation compared to rapid ART initiation within 7 days over a 12-month care- and medication-discontinuation risk horizon.

Results: Among the 1528 HIV- and 5373 AIDS-group individuals, 1329 and 4494 initiated same-day ART, respectively. Same-day ART initiation did not impact care or medication discontinuation among HIV-infected patients. However, it was associated with a significantly lower hazard of care discontinuation (adjusted average hazard ratio [aAHR] = 0.86, 95 % CI: 0.74–0.99) and a higher, though not significant, hazard of medication discontinuation (aAHR = 1.14, 95 % CI: 0.86–1.52) among patients with AIDS.

Conclusion: Same-day ART initiation demonstrates varying impacts on care and medication continuation. While it improves care retention, caution is advised regarding medication discontinuation among patients with AIDS.

Introduction

Human immunodeficiency virus (HIV) infection remains a critical global health challenge, affecting approximately 39 million people globally as of 2022 [1]. The virus attacks the immune system, leading to acquired immunodeficiency syndrome (AIDS), which increases susceptibility to opportunistic infections (OIs) and malignancies [2]. Modern antiretroviral therapy (ART) can effectively suppress HIV replication to undetectable viral loads, significantly reducing HIV disease progression, OIs, and mortality [3,4]. Most patients starting treatment generally take one to six months to reach this level [2,5]. However, attrition from ART after HIV diagnosis is high due to poor linkage between testing and care [6]. Consequently, there has been a

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growing body of research investigating the optimal eligibility criteria and initiation time for ART to maximize clinical benefits without compromising retention in treatment [6].

Before 2017, standard ART initiation involved a series of at least three pre-ART counseling sessions, from three weeks to several months, aimed at detecting and treating OIs [7,8]. This approach inadvertently led to significant loss of care [9]. Thus, the World Health Organization (WHO) revised its guidelines in 2017, lowering eligibility requirements and recommending ART initiation within 7 days of HIV diagnosis for all infected adults without cryptococcal meningitis or tuberculosis [9]. The guidelines emphasized that the decision to start same-day treatment should be based on a patient's readiness and not coercion [9].

The 2017 WHO guidelines were initially supported by randomized controlled trials (RCTs) [7,8,10], advocating for same-day ART initiation. However, real-world observational studies yielded inconsistent results. Some show no significant improvement in retention [11,12], while others indicate conflicting results for loss-to-follow-up [13–17]. This inconsistency may be due to sample selection bias and inaccuracies in defining follow-up starting points [18]. Young adults in Africa display a high likelihood of early ART uptake but also face substantial non-retention rates, underscoring individual-level challenges such as stigma and disclosure as potential barriers to treatment compliance [15,16]. Without early adaptive counseling and adherence support, the potential drawbacks of same-day ART may outweigh its benefits in long-term retention and viral suppression [15].

In line with WHO guidelines, Taiwan initially implemented same-week ART initiation in 2018, advancing to same-day initiation in 2021[19]. Under Taiwan's National Health Insurance (NHI) system, patients with chronic illnesses can visit clinics every three months and receive prescription refills at NHI-contracted pharmacies, allowing them to collect medications for up to three months without additional visits [20]. While this system was designed to improve convenience by reducing time and costs on outpatient visits, the lack of monthly physician follow-ups raises concerns about patients skipping medication refills. An observational study at a single hospital in Taiwan demonstrated the positive impact of same-week ART initiation on care continuity [14]. However, a larger multi-hospital observational study found no significant effect of same-day ART initiation on care continuity or composite outcomes related to unfavorable events [11].

Although a 2023 study from Rwanda compared same-day and 1–7 days ART initiation in terms of loss to follow-up and viral suppression [13], their healthcare and social context differ significantly from Taiwan's. As Taiwan transitions from a same-week to a same-day ART initiation policy, population-based evidence on its impact on care and medication discontinuation remains limited. Additionally, previous studies did not differentiate between individuals newly diagnosed with early-stage HIV and those with AIDS, neglecting the potential confounding effect of disease severity. This study addresses a gap in observational research on ART initiation timing, particularly in Asia. We conducted a population-based cohort study in Taiwan, using a doubly robust estimation with propensity score weighting and weighted Cox regression to assess whether same-day ART initiation increases the risk of care and medication discontinuation compared to starting ART 1–7 days after diagnosis.

Materials and methods

Study design

This population-based cohort study investigated the effect of ART initiation timing on both care and medication discontinuation in individuals with incident HIV infection or AIDS. The study population was stratified into two groups: the HIV and AIDS groups. The cohort follow-up commenced at time zero, defined as the date of the first medical visit for an HIV/AIDS diagnosis. Within each group, we classified patients into two treatment arms: (1) same-day ART initiation, where the initial ART prescription date coincided with time zero, and (2) rapid ART initiation, with the first ART-prescription date occurring 1–7 days after time zero. Patients were monitored for one year from their time zero until the occurrence of an event (care discontinuation/ART discontinuation), disease progression, death, or conclusion of the study period (Fig. 1).

Data source

Taiwan's single-payer NHI system covers nearly 100 % of the population. We obtained data from the NHI claims database and the Cause of Death Data managed by the Health and Welfare Data Science Center under the Ministry of Health and Welfare in Taiwan. Data were obtained using anonymized IDs. We used six NHI datasets: ambulatory care expenditure by visitors, details of ambulatory care orders, inpatient expenditures by admission, details of inpatient orders, expenditures for prescriptions dispensed at contracted pharmacies, and details of prescriptions dispensed at contracted pharmacies. These datasets encompass all medical claims from insured individuals and provide comprehensive information on disease diagnoses, procedures, and prescriptions across various healthcare settings, including inpatient, outpatient, and emergency visits.

Study population

We identified patients whose first medical visit related to HIV/AIDS occurred between January 1, 2017, and December 31, 2021, with a five-year washout period. The target population comprised adult patients with HIV/AIDS who initiated ART within 7 days of the initial visit. We identified patients with HIV infection using the International Classification of Diseases, Tenth Revision, Clinical Modification (ICD-10-CM) code Z21, and those with AIDS using the ICD-10-CM code B20 as the primary diagnostic codes. Patients were excluded if they were diagnosed with tuberculosis or cryptococcal meningitis within 60 days preceding their initial HIV/AIDS visit, as these conditions might influence the timing of ART initiation.

Timing of ART initiation

Taiwan's HIV testing involves two stages: initial and follow-up confirmatory. To minimize the transmission risks during these tests,

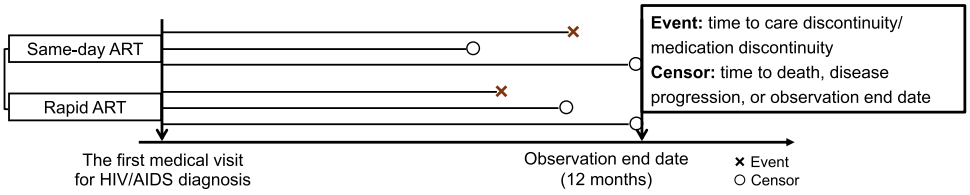

Fig. 1. Study design.

many facilities now offer both tests on the same day. Following confirmatory testing, patients diagnosed with HIV/AIDS may receive notifications via telephone, at the inspection agency, or during their initial medical visits. Consequently, the date of HIV notification may precede the first medical visit associated with the diagnosis of HIV/AIDS. We designated the date of the patient's first medical visit for HIV/AIDS as time zero. ART initiation was defined using the Anatomical Therapeutic Chemical codes (**Appendix** Table 1).

In cases where patients were initially diagnosed with HIV but did not start ART until after progression to AIDS, the timing of ART initiation was referenced to the initial medical visit related to AIDS.

Outcomes

We analyzed two time-to-event outcomes: care discontinuation and medication discontinuation, from patients' initial HIV/AIDS-related medical visits. Typically, stable patients with chronic illnesses receive three-month prescriptions during an outpatient visit—a one-month prescription for the current visit and two months for refills. Thus, patients were expected to obtain a new three-month prescription 90 days after the prior prescription date. Care discontinuation was defined as going more than 90 days without seeking medical care, with the discontinuation date set as the last outpatient visit. Medication discontinuation was defined as failing to claim ART prescriptions within 30 days after the expected pick-up date, with the discontinuation date set as the last pick-up date plus the days of drug supply. To account for these definitions, the follow-up period was extended to 15 months for care continuity and 13 months for medication continuity while monitoring care and medication discontinuation over one year.

Covariates

The covariates included demographic characteristics, medical history, hospital ownership, and ART-initiation policy implementation. The demographic characteristics included gender, age, residence, and NHI-enrollment salary. The study participants were categorized into two gender groups and four age groups: 18–29, 30–39, 40–49, and > 50 years old. Residence was based on the location of the medical institution that patients initially visited and was categorized into four groups: northern, central, southern, and eastern and outlying islands. Baseline NHI-enrollment salary was divided into four categories: < NT$30,000, NT$30,001–NT$50,000, NT$50,001–NT$70,000, and ≥NT$70,001. For patients with missing NHI-enrollment salaries, imputation was performed using the average NHI-enrollment salary within the respective age groups.

Medical history was defined as a history of more than two outpatient visits, or more than one hospitalization record related to the following conditions in the one year before their time zero: depression, substance abuse, hepatitis, and other sexually transmitted infections. For patients with AIDS, an OI was defined as a history of more than two outpatient visits or more than one hospitalization within 60 days before time zero (ICD-10-CM codes are detailed in the **Appendix**) [21,22].

Hospital ownership was determined based on the clinical characteristics at the patients' initial medical visit. Hospital ownership was categorized as public or private. The ART initiation policy was defined by a year-based indicator, signifying whether the patient's initial HIV/AIDS-related medical visit occurred after 2017, when Taiwan first implemented the rapid ART policy. Similarly, the same-day ART initiation policy was defined by another year-based indicator, marking whether the initial medical visit occurred after 2020, when Taiwan officially adopted the same-day ART policy.

Statistical analysis

We used Student's *t*-test and chi-squared test to compare baseline characteristics between the two ART-initiation groups, evaluated using the standardized mean difference (SMD), with an SMD > 0.1 considered a significant difference.

We employed a doubly robust estimation method to estimate the effect of the timing of ART initiation on care and medication discontinuation [23]. First, logistic regression was conducted to estimate patients' propensity to initiate ART on the same day to mitigate self-selection bias [24]. This regression model included all the variables mentioned in the *Covariates* subsection. This propensity score was used for stabilized inverse propensity score weighting to prevent an increased probability of Type I errors due to an inflated sample size [25]. Second, with the weighted pseudo sample based on stabilized inverse propensity score weights, a weighted Cox regression model estimated the average hazard ratio (AHR) for same-day ART initiation compared with rapid ART initiation to overcome the violation of the proportional hazard assumption [26,27]. A cause-specific hazard model was employed instead of a subdistribution hazard model because competing risk events (all-cause deaths) could be disregarded (**Appendix** Fig. 1). We adjusted for all potential confounders as described in the *Covariates* subsection.

Our study adhered to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines. Data analysis was performed using SAS (version 9.4; SAS Institute, Inc., Cary, NC, USA) and R (version 4.3.1; R Foundation for Statistical Computing, Vienna, Austria).

Results

Demographic characteristics

Between 2017 and 2021, of 2204 people newly diagnosed with HIV who had not been diagnosed with tuberculosis or cryptococcal meningitis within 60 days before their initial HIV visit, 1365 individuals started ART on the same day, 235 within the same week, 581 after one week, and 23 never initiated ART. Additionally, among 8411 individuals who were diagnosed with AIDS for the first time and had not been diagnosed with tuberculosis or cryptococcal meningitis within 60 days before their initial AIDS visit, 5688 people started ART on the same day, 908 within the same week, 1678 after one week, and 137 never initiated ART.

After excluding patients who started ART after one week, never initiated ART, and those with missing information, our study included 1528 individuals with HIV infection (Table 1) and 5373 with AIDS (Table 2) who initiated ART on the same day or within 1–7 days. After stabilized weighting, the observed baseline characteristics between the two groups with HIV infection were similar, except for age and NHI enrollment salary. Among participants with HIV infection, 97 % were men, with an average age of 31 years. More than half reported a monthly salary below NT$ 30,000, and nearly 80 % resided in northern Taiwan. Over 95 % did not have a medical history of depression, substance use, or hepatitis in the previous year, but approximately one-third had a history of other sexually transmitted infections. Similar characteristics were observed in the AIDS group, except for slight differences in residence compared with those with HIV infection. More than 20 % of the patients in the AIDS group had a history of OI.

Inferential statistics

The Kaplan–Meier curves (Fig. 2) reveal divergent patterns between care and medication continuation. At one-year follow-up, approximately 40 % of HIV/AIDS patients experienced care discontinuation (Fig. 2a,b), while only 15 % experienced medication

Table 1
Baseline characteristics of patients with HIV infection before and after inverse probability treatment weighting.

	Unweighted cohort (N = 1528)					Weighted cohort (N = 1530.90)				
	Same-day ART initiation (N = 1329)		Rapid ART initiation (N = 199)			Same-day ART initiation (N = 1336.62)		Rapid ART initiation (N = 194.29)		
	N	%	N	%	SMD#	N	%	N	%	SMD#
Demographic Characteristics										
Men	1285	96.69	195	97.99	0.08	1294.89	96.88	189.23	97.40	0.03
Age (mean ± SD), year	31.59 ± 9.30		32.82 ± 10.89		0.12	31.78 ± 9.57		30.70 ± 8.81		0.12
18–29	667	50.19	99	49.75	0.11	670.04	50.13	105.75	54.43	0.13
30–39	431	32.43	57	28.64		425.51	31.83	63.96	32.92	
40–49	162	12.19	21	10.55		158.34	11.85	15.07	7.76	
≥ 50	69	5.19	22	11.06		82.73	6.19	9.51	4.90	
NHI enrollment salary (mean ± SD), NT$	28,958.00 ± 24,145.40		29,939.30 ± 27,212.20		0.04	28,642.30 ± 24,075.70		29,240.10 ± 27,430.90		0.02
≤ 30,000	786	59.14	121	60.80	0.04	798.16	59.71	129.12	66.46	0.13
30,001–50,000	366	27.54	52	26.13		362.31	27.11	45.27	23.30	
50,001–70,000	107	8.05	18	9.05		108.08	8.09	11.95	6.15	
≥ 70,000	70	5.27	8	4.02		68.07	5.09	7.96	4.10	
Residence area										
Northern	1058	79.61	162	81.41	0.05	1061.23	79.40	149.46	76.93	0.07
Central	54	4.06	3	1.51		49.41	3.70	4.20	2.16	
Southern	167	12.57	16	8.04		159.44	11.93	30.72	15.81	
Eastern and outlying islands	50	3.76	18	9.05		66.53	4.98	9.91	5.10	
Medical History										
Depression	64	4.82	14	7.04	0.09	68.19	5.10	7.81	4.02	0.05
Substance use	34	2.56	7	3.52	0.06	36.64	2.74	4.30	2.21	0.03
Hepatitis	41	3.09	6	3.02	< 0.01	40.85	3.06	4.19	2.16	0.06
Other sexually transmitted infections	360	27.09	77	38.69	0.25	389.89	29.17	59.39	30.57	0.03
Medication Attributes										
Hospital ownership										
Public	705	53.05	121	60.80	0.16	720.24	53.89	111.69	57.49	0.07
Non-public	624	46.95	78	39.20		616.38	46.11	82.60	42.51	
ART Initiation Policy										
Before 2018	182	13.69	74	37.19	0.71	232.43	17.39	37.96	19.54	0.03
Between 2018 and 2020	902	67.87	119	59.80		885.80	66.27	116.67	60.05	
After 2020	245	18.43	6	3.02		218.38	16.34	39.66	20.41	

Abbreviations: SMD, Standardized mean difference; NHI, National Health Insurance; ART, Antiretroviral therapy.
#Standardized mean difference (SMD) of smaller than 0.1 indicates that the difference in this variable between groups can be considered negligible.

Table 2
Baseline characteristics of patients with AIDS before and after inverse probability treatment weighting.

	Unweighted cohort (N = 5373)					Weighted cohort (N = 5383.44)				
	Same-day ART initiation (N = 4494)		Rapid ART initiation (N = 879)			Same-day ART initiation (N = 4491.63)		Rapid ART initiation (N = 891.81)		
	N	%	N	%	SMD#	N	%	N	%	SMD#
Demographic Characteristics										
Men	4359	97.00 %	855	97.27 %	0.02	4358.40	97.03	873.22	97.92	0.06
Age (mean ± SD), year	33.02 ± 10.10		31.84 ± 9.70		0.12	32.88 ± 10.10		33.03 ± 9.84		0.02
18–29	1982	44.10	440	50.06	0.11	2020.13	44.98	385.65	43.24	0.04
30–39	1513	33.67	279	31.74		1493.45	33.25	297.75	33.39	
40–49	653	14.53	96	10.92		631.33	14.06	138.11	15.49	
≥ 50	346	7.70	64	7.28		346.72	7.72	70.31	7.88	
NHI enrollment salary (mean ± SD), NT$	25,600.60 ± 22,109.70		25,486.80 ± 20,628.90		0.01	25,615.50 ± 22,103.80		24,247.00 ± 19,855.60		0.07
≤ 30,000	2959	65.84	576	65.53	0.01	2957.80	65.85	604.75	67.81	0.06
30,001–50,000	1103	24.54	209	23.78		1096.15	24.40	218.02	24.45	
50,001–70,000	284	6.32	70	7.96		293.90	6.54	45.73	5.13	
≥ 70,000	148	3.29	24	2.73		143.78	3.20	23.30	2.61	
Residence area										
Northern	2087	46.44	399	45.39	0.06	2084.72	46.41	395.37	44.33	0.01
Central	1028	22.87	175	19.91		1010.40	22.50	224.19	25.14	
Southern	1288	28.66	287	32.65		1304.90	29.05	257.09	28.83	
Eastern and outlying islands	91	2.02	18	2.05		91.61	2.04	15.16	1.70	
Medical History										
Depression	202	4.49	47	5.35	0.04	206.27	4.59	37.09	4.16	0.02
Substance use	165	3.67	16	1.82	0.11	151.15	3.37	20.18	2.26	0.07
Hepatitis	191	4.25	18	2.05	0.13	174.93	3.89	25.88	2.90	0.06
Other sexually transmitted infections	1176	26.17	245	27.87	0.04	1189.62	26.49	238.70	26.77	0.01
Opportunistic infections	1083	24.10	24	2.73	0.66	926.02	20.62	188.40	21.13	0.01
Medication Attributes										
Hospital ownership										
Public	1973	43.90	569	64.73	0.43	2125.98	47.33	423.61	47.50	< 0.01
Non-public	2521	56.10	310	35.27		2365.65	52.67	468.20	52.50	
ART Initiation Policy										
Before 2018	718	15.98	325	36.97	0.56	871.14	19.39	165.18	18.52	0.02
Between 2018 and 2020	2924	65.06	493	56.09		2856.59	63.60	572.72	64.22	
After 2020	852	18.96	61	6.94		763.91	17.01	153.91	17.26	

Abbreviations: SMD, Standardized mean difference; NHI, National Health Insurance; ART, Antiretroviral therapy.
#Standardized mean difference (SMD) of smaller than 0.1 indicates that the difference in this variable between groups can be considered negligible.

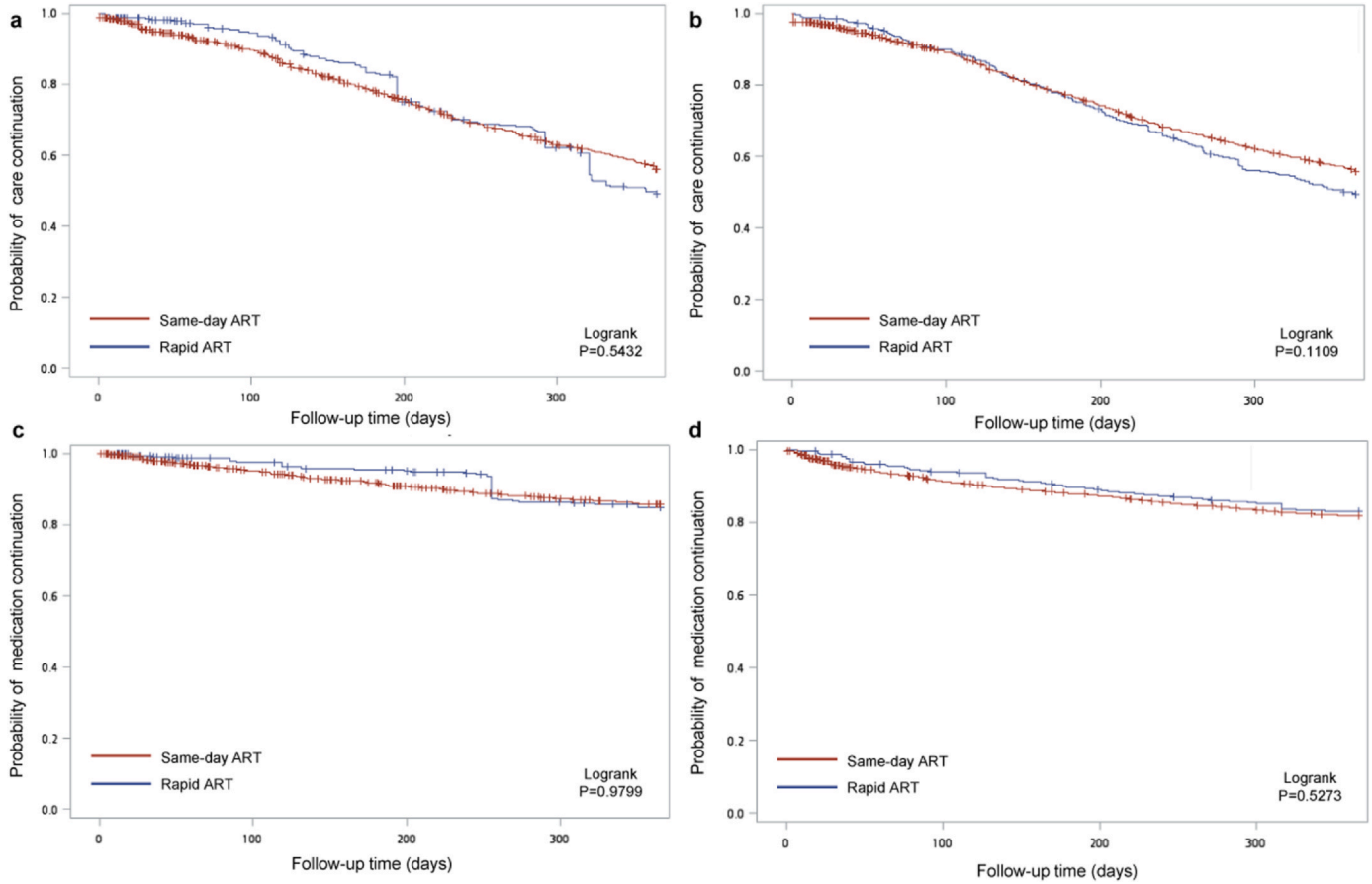

Fig. 2. Probabilities of care/medication continuity among patients with HIV infection or AIDS over time. Probability of care continuation among patients with (a) HIV infection and (b) AIDS. Probability of medication continuation among patients with (c) HIV infection and (d) AIDS.

discontinuation (Fig. 2c,d). After 150 days, rapid ART initiation showed a higher rate of care discontinuation compared to same-day ART initiation in both HIV and AIDS groups (Fig. 2a,b). In contrast, the two groups had similar patterns of medication retention over time in both the HIV and AIDS groups (Fig. 2c,d).

The results of weighted Cox regressions examining the effect of ART initiation timing on care and medication discontinuation among participants with HIV and AIDS are shown in Tables 3 and 4, respectively. Within the HIV group, same-day ART initiation did not significantly impact either care (adjusted AHR, or aAHR = 0.93, 95 % CI: 0.69–1.25) or medication discontinuation (aAHR = 1.07, 95 % CI: 0.51–2.20). However, in the AIDS group, same-day ART initiation reduced the hazard of care discontinuation (aAHR = 0.86, 95 % CI: 0.74–0.99), but was not significantly associated with medication discontinuation (aAHR = 1.14, 95 % CI: 0.86–1.52).

Discontinuation of both care and medication varied according to demographics and covariates. Among the HIV group, those in older age groups (40–49 years: aAHR = 0.72, 95 % CI: 0.54–0.97) and with a middle NHI enrollment salary (NT$30,001–50,000: aAHR = 0.77, 95 % CI: 0.63–0.94) showed reduced hazards of care discontinuation. People living with HIV receiving care in the southern (aAHR = 0.55, 95 % CI: 0.39–0.77) and eastern and outlying islands regions (aAHR = 0.40, 95 % CI: 0.21–0.74) also showed reduced hazards of care discontinuation. In contrast, patients with a history of substance use had higher hazards of care discontinuation (aAHR = 1.81, 95 % CI: 1.09–2.98). For medication discontinuation, HIV-positive patients with higher enrollment salaries and initiated ART between 2018 and 2020 showed lower hazards of medication discontinuation (aAHR = 0.64, 95 % CI: 0.43–0.96). Patients with a history of substance use (aAHR = 3.81, 95 % CI: 2.18–6.68) and those from non-public hospitals exhibited higher hazards of medication discontinuation (aAHR = 1.43, 95 % CI: 1.01–2.02).

In the AIDS group, lower hazard ratios for care discontinuation were observed among patients in the highest enrollment salary group (> NT$70,000: aAHR= 0.60, 95 % CI: 0.45–0.79), those in the central (aAHR = 0.89, 95 % CI: 0.79–0.99) and southern regions (aAHR = 0.62, 95 % CI: 0.55–0.70), and those with a history of OI (aAHR = 0.56, 95 % CI: 0.47–0.67). However, female patients (aAHR = 1.37, 95 % CI: 1.06–1.76) and those who initiated ART after 2020 had higher hazards of care discontinuation (aAHR = 1.20, 95 % CI: 1.03–1.41). For medication discontinuation, the hazard ratios decreased as patients' NHI enrollment salary increased. In contrast, women (aAHR = 1.50, 95 % CI: 1.07–2.12), those aged over 50 years (aAHR = 1.31, 95 % CI: 1.01–1.70), those residing in eastern and outlying islands regions (aAHR = 1.59, 95 % CI: 1.05–2.39) and those with a history of opportunistic infections (aAHR = 1.61, 95 % CI: 1.32–1.96) had higher hazard ratios for medication discontinuation.

Discussion

The results revealed about 60 % of HIV/AIDS patients continue care, and 85 % remain on medication during the first year after diagnosis. Same-day ART initiation significantly improved care continuity only in the AIDS group, with differing effects noted on care and medication continuity between HIV and AIDS stages. To the best of our knowledge, this is the first population-based study to assess the impact of ART initiation timing on care and medication discontinuation by disease stages.

Table 3
Weighted Cox model for one-year care and medication discontinuation among patients with HIV infection who initiated ART within 7 days of their medical visit.

	Care discontinuation		Medication discontinuation	
	cAHR (95 % CI)	aAHR (95 % CI)	cAHR (95 % CI)	aAHR (95 % CI)
Same-day ART initiation (REF. = Rapid ART initiation)	0.93 (0.68, 1.27)	0.93 (0.69, 1.25)	0.99 (0.43, 2.26)	1.07 (0.51, 2.20)
Demographic Characteristics				
Women (REF. = Men)	1.15 (0.72, 1.83)	1.18 (0.73, 1.92)	1.39 (0.65, 2.97)	1.16 (0.52, 2.62)
Age (REF. = 18–29), year				
30–39	0.87 (0.72, 1.06)	0.89 (0.73, 1.08)	0.64 (0.44, 0.93)	0.75 (0.51, 1.09)
40–49	0.74 (0.55, 0.98)	0.72 (0.54, 0.97)	0.75 (0.45, 1.23)	0.82 (0.49, 1.37)
≥ 50	0.76 (0.48, 1.21)	0.69 (0.43, 1.09)	0.65 (0.26, 1.62)	0.45 (0.17, 1.14)
NHI enrollment salary (REF. = ≤30,000), NT$				
30,001–50,000	0.82 (0.66, 1.00)	0.77 (0.63, 0.94)	0.56 (0.38, 0.82)	0.56 (0.39, 0.81)
50,001–70,000	0.87 (0.62, 1.22)	0.86 (0.61, 1.21)	0.20 (0.07, 0.56)	0.22 (0.08, 0.61)
≥ 70,000	1.04 (0.74, 1.47)	1.09 (0.76, 1.56)	0.13 (0.03, 0.52)	0.15 (0.04, 0.63)
Residence area (REF. = Northern)				
Central	1.21 (0.78, 1.87)	1.19 (0.76, 1.87)	1.16 (0.56, 2.40)	1.11 (0.52, 2.37)
Southern	0.56 (0.40, 0.80)	0.55 (0.39, 0.77)	0.90 (0.53, 1.52)	0.82 (0.48, 1.39)
Eastern and outlying islands	0.42 (0.23, 0.80)	0.40 (0.21, 0.74)	1.50 (0.74, 3.07)	1.13 (0.56, 2.29)
Medical History				
Depression (REF. = No history)	1.06 (0.69, 1.63)	0.97 (0.63, 1.51)	1.58 (0.83, 3.00)	1.16 (0.63, 2.14)
Substance use (REF. = No history)	1.63 (1.00, 2.64)	1.81 (1.09, 2.98)	3.22 (1.82, 5.70)	3.81 (2.18, 6.68)
Hepatitis (REF. = No history)	0.84 (0.49, 1.41)	0.88 (0.51, 1.51)	1.13 (0.49, 2.62)	1.37 (0.62, 3.02)
Other sexually transmitted diseases (REF. = No history)	1.06 (0.87, 1.29)	1.07 (0.89, 1.30)	0.98 (0.69, 1.40)	0.94 (0.67, 1.31)
Medication Attributes				
Hospital ownership (REF. = Public)	0.96 (0.80, 1.14)	1.06 (0.89, 1.27)	1.45 (1.03, 2.04)	1.43 (1.01, 2.02)
ART Initiation Policy (REF. = Before 2018)				
Between 2018 and 2020	0.97 (0.75, 1.24)	0.98 (0.76, 1.25)	0.67 (0.45, 0.99)	0.64 (0.43, 0.96)
After 2020	1.12 (0.81, 1.54)	1.14 (0.84, 1.55)	0.86 (0.45, 1.66)	0.83 (0.46, 1.50)

cAHR, crude average hazard ratio; aAHR, adjusted average hazard ratio; CI, Confidence interval; NHI, National Health Insurance; ART, Antiretroviral therapy

Same-day ART and care discontinuation

Our study demonstrated that same-day ART reduced the hazard of care discontinuation in the AIDS group, whereas a Taiwanese observational study across multiple clinical settings found no significant difference in care retention between same-day ART and initiation within 1–14 days of diagnosis [11]. When we combined the HIV and AIDS groups and applied their 180-day outcome definition, our results aligned with theirs (aAHR = 1.14, 95 % CI: 0.82–1.57, data not shown). However, using a 90-day outcome definition for this combined population revealed that same-day ART initiation significantly lowered the risk of care discontinuation (**Appendix** Table 3, aAHR = 0.82, 95 % CI: 0.74–0.90), consistent with our base-case results in separate populations. This scenario analysis suggests that same-day ART initiation may reduce early care discontinuation but has minimal impact on those unlikely to return.

Our findings align with those of RCTs conducted in Africa, but contradict observational study results from Africa [7,8]. Taiwan's

Table 4
Weighted Cox model for one-year care and medication discontinuation among patients with AIDS who initiated ART within 7 days of their medical visit.

	Care discontinuation		Medication discontinuation	
	cAHR (95 % CI)	aAHR (95 % CI)	cAHR (95 % CI)	aAHR (95 % CI)
Same-day ART initiation (REF. = Rapid ART initiation)	0.88 (0.74, 1.04)	0.86 (0.74, 0.99)	1.12 (0.84, 1.50)	1.14 (0.86, 1.52)
Demographic Characteristics				
Women (REF. = Men)	1.35 (1.05, 1.73)	1.37 (1.06, 1.76)	1.73 (1.24, 2.41)	1.50 (1.07, 2.12)
Age (REF. = 18–29), year				
30–39	0.89 (0.80, 0.99)	0.94 (0.85, 1.04)	0.95 (0.80, 1.13)	0.95 (0.80, 1.13)
40–49	0.81 (0.69, 0.96)	0.90 (0.76, 1.06)	0.96 (0.76, 1.22)	0.91 (0.70, 1.17)
≥ 50	1.03 (0.87, 1.23)	1.09 (0.90, 1.32)	1.46 (1.11, 1.91)	1.31 (1.01, 1.70)
NHI enrollment salary (REF. = ≤30,000), NT$				
30,001–50,000	0.94 (0.84, 1.05)	0.90 (0.80, 1.00)	0.54 (0.45, 0.66)	0.56 (0.46, 0.68)
50,001–70,000	0.95 (0.79, 1.13)	0.89 (0.74, 1.07)	0.51 (0.36, 0.72)	0.56 (0.40, 0.79)
≥ 70,000	0.62 (0.47, 0.82)	0.60 (0.45, 0.79)	0.32 (0.19, 0.56)	0.31 (0.18, 0.54)
Residence area (REF. = Northern)				
Central	0.94 (0.83, 1.05)	0.89 (0.79, 0.99)	0.85 (0.71, 1.02)	0.86 (0.71, 1.04)
Southern	0.64 (0.57, 0.72)	0.62 (0.55, 0.70)	1.19 (0.99, 1.42)	1.12 (0.94, 1.35)
Eastern and outlying islands	1.26 (0.95, 1.67)	1.26 (0.94, 1.67)	1.57 (1.06, 2.34)	1.59 (1.05, 2.39)
Medical History				
Depression (REF. = No history)	0.94 (0.77, 1.16)	0.98 (0.79, 1.22)	1.56 (1.11, 2.18)	1.33 (0.98, 1.80)
Substance use (REF. = No history)	0.98 (0.76, 1.27)	1.01 (0.77, 1.32)	1.48 (1.06, 2.05)	1.30 (0.91, 1.86)
Hepatitis (REF. = No history)	0.90 (0.70, 1.15)	0.91 (0.70, 1.19)	1.04 (0.74, 1.46)	0.89 (0.62, 1.27)
Other sexually transmitted infections (REF. = No history)	1.07 (0.97, 1.19)	1.03 (0.93, 1.14)	1.08 (0.91, 1.27)	1.13 (0.96, 1.33)
Opportunistic infections (REF. = No history)	0.55 (0.47, 0.65)	0.56 (0.47, 0.67)	1.59 (1.30, 1.95)	1.61 (1.32, 1.96)
Medication Attributes				
Hospital ownership (REF. = Public)	0.90 (0.82, 0.99)	0.95 (0.87, 1.04)	0.92 (0.79, 1.07)	0.88 (0.75, 1.02)
ART Initiation Policy (REF. = Before 2018)				
Between 2018 and 2020	0.90 (0.80, 1.02)	0.93 (0.82, 1.05)	0.87 (0.72, 1.05)	0.92 (0.76, 1.12)
After 2020	1.17 (1.01, 1.37)	1.20 (1.03, 1.41)	1.07 (0.84, 1.35)	1.14 (0.90, 1.45)

cAHR, crude average hazard ratio; aAHR, adjusted average hazard ratio; CI, Confidence interval; NHI, National Health Insurance; ART, Antiretroviral therapy

healthcare system for HIV/AIDS is recognized for its high standards, supported by a national HIV/AIDS program, a robust healthcare infrastructure, and universal health insurance coverage. This alignment with RCTs in Africa may be since RCTs often provide ART as part of a comprehensive approach involving multiple interventions—such as adequate service-provider allocation and additional adherence counseling [16]—which parallels the healthcare resources available in Taiwan.

Our findings differ from those of observational studies in Africa [15,16] due to several potential factors. First, regional disparities in healthcare systems for HIV/AIDS, particularly regarding screening, reporting, monitoring, and access to affordable care, may explain the discrepancies. Second, many previous observational studies did not account for selection bias, which could have influenced their outcome estimates [18]. Third, our study set the date of the patient's first medical visit for HIV/AIDS as the time-zero reference point, while other cohort studies used different time-zero definitions for the same-day and rapid ART initiation groups [18]. Last, prior studies often did not stratify their populations by disease stage (HIV versus AIDS), which can affect health-seeking behaviors and lead to varied interpretations of the results.

Same-day ART and medication discontinuation

Similar to observational studies conducted in South Africa and Ethiopia, our results indicated that same-day ART initiation was associated with an increased risk of medication discontinuation among patients with AIDS, although this was not statistically significant [28,29]. Previous research used the transtheoretical behavioral change model to explain the barriers to and facilitators of ART uptake, underscoring that patients required two to four weeks to adjust before initiating treatment [30]. Starting treatment without progressing beyond the contemplation stage inadvertently diminishes long-term medication adherence [30].

Some patients receiving same-day ART may commence treatment before disclosing their HIV-positive status to their partners or family. Without immediate support from partners and family members, these patients are more likely to conceal treatment and experience self-stigmatization, which negatively influences their medication adherence [31,32]. This was supported by a recent United States study [33]. Additionally, ART may cause side effects such as nausea, headaches, insomnia, diarrhea, and skin rashes [34]. These responses lead patients to question the treatment benefits [31] and instill fear of medications, thereby reducing adherence [35].

Details on two care-seeking behaviors

Although same-day ART did not significantly affect medication discontinuation, the effect sizes and direction differed between the two care-seeking behaviors. Same-day ART had a preventive impact on care discontinuity, especially in the AIDS group, while it might increase medication discontinuation. This difference in care-seeking behaviors may be due to prescription refilling for ART. If the disease state of people living with HIV is stable, they may need to make one visit to the clinic to collect ART for up to three months. Consequently, the date of the clinic visit and the date of medication pick-up may differ.

Patients with comorbidities (e.g., OIs and other sexually transmitted infections) may choose to remain in care to treat these illnesses, irrespective of their ART status. Additionally, some individuals experience adverse reactions to ART that lead to short periods of repeated treatment interruption while still adhering to clinic visits. A study from China found that approximately 50 % of HIV-infected individuals resumed care within 16 weeks of interrupting their medication regimens [36]. A prior systematic review indicated that unstructured treatment interruptions lasted between 11.5 days and 18 months [37].

Strengths and limitations

Compared with most observational studies [11–13,15–17,29,38], ours has the advantage of employing a weighted Cox regression model. Our population statistics showed notable differences in the background characteristics between the same-day and rapid ART-initiation groups, especially in terms of HIV infection severity and history of OIs. Thus, comparing medication groups may be insufficient without considering sample selection bias. Furthermore, our population-based study provides updated evidence for Taiwan, overcoming limitations of prior research [11] conducted during the COVID-19 pandemic, including restricted recruitment from specific medical centers.

This study has some limitations. The first is the potential misclassification of ART-initiation timing, as the NHI claims data lack information about patients' awareness of their HIV status. In Taiwan, HIV screening data are anonymized due to Taiwan Center for Disease Control's policy, limiting our ability to precisely align ART initiation timing with the date when patients receive electronic notifications to visit physicians. Therefore, we used the date of the first medical visit as a proxy for a confirmed diagnosis. Since only physicians can diagnose and prescribe ART during medical visits, this approach was the most appropriate for examining care-seeking behaviors and ART initiation in this study.

Second, our outcome definitions were based on practical judgment using NHI claims data rather than a scientific standard. Notably, the definition of medication discontinuation depends on claims data, which may not reflect cases where patients received but did not use ART. As no standard definitions exist for care and medication discontinuation, our results may vary with different definitions. Nevertheless, sensitivity analyses confirmed the robustness of our findings. Third, the rapid ART-initiation group might have had an immortal time compared to the same-day ART-initiation group. However, with only 0.09 % of patients dying within 7 days of their first medical visit (0 % for patients with HIV infection), its impact was minimal.

Fourth, we exclusively identified patients who underwent government-subsidized HIV testing; thus, individuals opting for self-paid HIV testing and those not seeking medical care remain unaccounted for in the NHI claims data. Fifth, 3.8 % of patients with AIDS had a prior HIV diagnosis before time zero but had not initiated ART at the time of their HIV diagnosis. The baseline characteristics of these patients differed from those who were diagnosed with AIDS without a preceding HIV diagnosis. To account for this, we included a binary variable indicating HIV history in our doubly robust models as a sensitivity analysis. The results remained consistent with our base-case findings: for care discontinuation, the aAHR was 0.90 (95 % CI = 0.77–1.04), and for medication discontinuation, the aAHR was 1.10 (95 % CI = 0.82–1.48). Last, the absence of key variables such as clinical examination data (CD4 + cell count and viral load) and self-paid, pre-exposure, and prophylaxis usage may impact the specification of the propensity score mode.

Ethics approval

The Institutional Review Board of National Yang Ming Chiao Tung University, Taiwan (IRB), approved this study (NYCU112154AE).

Consent to participate

The IRB waived the requirement for participants to consent to participate in this study because of its low-risk nature. Furthermore, the possible risk to the study participants was not greater than that to those who did not participate, and the waiver of the requirement to obtain informed consent did not affect the rights and interests of the study participants.

Consent to publish

Consent for publication was not required because the IRB agreed that this study did not require consent to participate.

Conclusion

Same-day ART initiation has diverse effects on the continuation of care and medication. While it enhances care retention in people with AIDS, it may also heighten the risk of medication discontinuation, although this was not statistically significant. Medical professionals and policymakers should note this issue to ensure effective HIV/AIDS care management.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.jiph.2025.102677.

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