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Patient Transfers and Their Impact on Gaps in Clinical Care: Differences by Gender in a Large Cohort of Adults Living with HIV on Antiretroviral Therapy in South Africa

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Abstract

For people living with HIV (PLWH), patient transfers may affect engagement in care. We followed a cohort of PLWH in Cape Town, South Africa who tested positive for HIV in 2012–2013 from ART initiation in 2012–2016 through December 2016. Patient transfers were defined as moving from one healthcare facility to another on a different day, considering all healthcare visits and recorded HIV-visits only. We estimated incidence rates (IR) for transfers by time since ART initiation, overall and by gender, and associations between transfers and gaps of > 180 days in clinical care. Overall, 4,176 PLWH were followed for a median of 32 months, and 8% (HIV visits)—17% (all healthcare visits) of visits were patient transfers. Including all healthcare visits, transfers were highest through 3 months on ART (IR 20.2 transfers per 100 visits, 95% CI 19.2–21.2), but increased through 36 months on ART when only HIV visits were included (IR 9.7, 95% CI 8.8–10.8). Overall, women were more likely to transfer than men, and transfers were associated with gaps in care (IR ratio [IRR] 3.06 95% CI 2.83–3.32; HIV visits only). In this cohort, patient transfers were frequent, more common among women, and associated with gaps in care.

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Keywords

HIV; ART; Patient transfer; retention in HIV care; Clinic transfer

Introduction

Achieving UNAIDS' 90–90–90 goals to end the HIV epidemic will require sustained engagement in HIV care and ongoing viral suppression among people living with HIV (PLWH) [1]. As universal access to ART scales up globally and PLWH engage in lifetime care and treatment, how and where PLWH access care and treatment is becoming increasingly important. Over time, PLWH may choose to transfer their HIV care to different care facilities for a variety of reasons, including migration, stigma, changes in their health status, employment, or residence [2–4]. Patient transfers may increase the likelihood of gaps in ART treatment access or disengagement from HIV care [5]. However, few data exist quantifying the frequency of patient transfers over time and examining their impact on clinical care outcomes in large cohorts of PLWH on ART.

Among PLWH, there is reason to hypothesize that the frequency and impact of patient transfers may differ by gender. For example, among women, pregnancy and the postpartum period are well-documented to be high-risk periods for disengagement from HIV care [5–8]. In South Africa, high rates of postpartum mobility and patient transfers have been reported as critical challenges to sustained retention in HIV care through the perinatal period [9–11]. However, relative to women outside of perinatal period, men living with HIV are more likely to initiate ART with more advanced disease, to be lost to follow up (LTFU) from HIV care, and to have higher rates of mortality [12–17]. In order to understand how patient transfers influence sustained engagement in HIV care, differences by gender need to be taken into account.

The goal of the present analysis is to characterize patient transfers over time in a large cohort of PLWH who initiated ART between 2012 and 2016 in Cape Town, South Africa. In addition, we examine whether patient transfers are associated with gaps in clinical care of six months or more. We describe trends in patient transfers and associations with gaps in clinical care among all patients and stratified by gender.

Methods

Study Setting and Data Source

Data come from the Western Cape Province of South Africa. The overall prevalence of HIV in the Western Cape is 6.6%, but considerable variation exists in the region [18, 19]. Over time, eligibility for ART in South Africa has changed. Between 2012 and 2015, PLWH in South Africa with a CD4 count < 350 cells/mm^3 were eligible to initiate lifelong ART [20]. In 2015, South Africa adopted universal ART for all pregnant and breastfeeding women, known as Option B + , and in 2016 extended universal ART access to all PLWH, regardless of CD4 count or clinical stage [21, 22]. At ART initiation, PLWH are typically registered in a paper-based or electronic medical record system. PLWH are expected to receive follow-up care at the clinic where they initiate ART or, once they are stable on ART, through decentralized adherence clubs facilitated by community health workers linked to a clinic [23].

The Western Cape Provincial Health Data Centre (PHDC) links clinical, pharmacy, laboratory, and available vital status data from all public-sector healthcare facilities within the province using unique patient identifiers, as part of ongoing efforts to support patient engagement in HIV care [24, 25]. Linked data were used to identify a cohort of PLWH in a sub-district of the Western Cape who were at least 15 years of age at their first positive HIV test between 2012 and 2013, received a CD4 cell count measure at enrollment, and had a civil identification number. Data on cohort participants were available through December 2016. Fifteen health facilities within the sub-district provide HIV testing, and several non-governmental organizations promote and perform testing, referring those who test positive for HIV to public clinics for follow-up care. Information on all healthcare visits (not just HIV visits) at public clinics throughout the Western Cape Province was linked with clinical and demographic data for all cohort participants by the Western Cape Department of Health. The primary purpose of this original cohort was to examine associations between gender, HIV testing, and subsequent HIV service uptake and outcomes [17]. South Africa has a national death registry; however, data for cohort members were not authorized for linkage to the national death registry. Ethical approval and a waiver of informed consent for the use of de-identified routine data were provided by the University of Cape Town (Protocol number 320/2015).

Study Population

Participants from the original cohort of those testing positive in 2012 and 2013 were included in the present analysis if they initiated ART between 2012 and 2016 (n = 4184) and had a healthcare visit after ART initiation (n = 4176; Fig. 1). Participants were followed from ART initiation through their last recorded healthcare encounter prior to death or administrative censoring on December 21, 2016.

Measures

A patient transfer was defined as any switch from one health facility to another that did not occur on the same day. When a participant visited multiple health facilities on the same day, we used the visit at the most frequented facility over the follow-up period in order to identify patient transfers between the preceding or subsequent healthcare encounters. Multiple transfers between the same two facilities were counted individually. Hospital admission records were excluded, since it is unlikely for ART to be given at this type of healthcare visit. Healthcare visits were categorized by encounter type; however, when participants attend a health facility for more than one reason (e.g. for prenatal care and ART), administrative systems do not always capture the visit as related to HIV care, leading to an undercount of HIV-related visits. Thus, to provide a range of estimates, we defined patient transfers in two ways, first including all available healthcare visit information (e.g. “all visits analysis”) and second including only recorded HIV visits (e.g. “recorded HIV visits analysis”), defined as encounters related to “ART visits,” “dispensing visits,” or a CD4 count or viral load lab test. Our data did not contain information on the reason for transfer, thus we were unable to distinguish between "official" transfers (e.g. when the original facility was aware of the transfer) and "silent" transfers (e.g. when the facility was not aware of the transfer).

In South Africa, PLWH typically receive a three- to six-month supply of ART at each visit. Therefore, we defined a gap in clinical care as no healthcare visits for greater than 180 days (6 months). Covariate information available in our data was limited to gender, age at ART initiation, year of ART initiation (2015 and 2016 were collapsed into one category for statistical models due to the small number who initiated ART in 2016 in this cohort), and CD4 count at enrollment, defined as a CD4 count within three months of first testing positive for HIV during the study period.

Statistical Analysis

The goal of the analysis was to describe patient transfers over time in a large cohort of PLWH on ART and examine whether visits with a patient transfer were associated with gaps in clinical care of > 180 days. All relationships were examined overall and stratified by gender. First, we quantified patient transfers among all healthcare visits and among recorded HIV visits only. Patient transfers were quantified among visits (all healthcare or HIV only) as well as among individual participants. Next, we used Poisson regression to estimate crude incidence rates (IR) for patient transfers by time since ART initiation and by ART treatment era (2012–2014 CD4 count < 350, 2015 Option B + , 2016 universal ART), overall and by gender for all visits and for recorded HIV visits only. Incidence rate ratios (IRR) were estimated to compare the rate of patient transfers between men and women by time since ART initiation and ART treatment era. Finally, to investigate the association between all healthcare visits or only recorded HIV visits with a patient transfer and a gap in clinical care of > 180 days, we used Poisson models with generalized estimating equations to estimate IR ratios (IRR) and to account for the correlation between multiple visits per participant. IRR were estimated overall and by gender and adjusted for year of ART initiation, age, and gender (non-stratified estimates only). Gaps in clinical care were defined using only person-time when a participant was in care (e.g. had a recorded healthcare or HIV visit) and prior to recorded mortality dates for participants who died. All analyses were performed using Stata 13 (StataCorp, College Station, TX).

Results

We included 4,176 adults with at least one follow-up visit who initiated ART between 2012 and 2016 in a sub-district of the Western Cape (Fig. 1). When analyses were restricted to recorded HIV visits only, 3,821 participants had data available and were included. The majority of the study population were women (67.7%; Table 1). Nearly three-quarters of participants were between 20 and 39 years of age at the time of their HIV positive test in 2012 or 2013. Nearly all (99%) participants initiated ART prior to the availability of universal ART in South Africa. Over half the cohort (55%) had a CD4 count ≤ 350 cells/mm^3 when they tested positive for HIV.

Among 83,060 total healthcare visits, 17% (n = 13,819) met the definition of a patient transfer (18% for women vs. 14% for men). When analyses were restricted to HIV visits only, among 38,436 recorded HIV visits, 8% met the definition of a patient transfer (8% for women vs. 6% for men). When all healthcare visits were included, participants transferred a median of two times (range 0–48) during follow-up and had a median of 17 days (IQR 6, 39) between a transfer and a subsequent healthcare visit. When only recorded HIV visits were included, participants transferred a median of 0 times (range 0–26) and had a median of 34 days (IQR 13, 120) between HIV visits. Over a median of 32 months (IQR 14–40) of follow-up on ART, 65% of participants transferred healthcare facilities at least once, including 70% of women and 56% of men. When HIV visits only were included, 31% of participants transferred at least once (34% of women and 26% of men) (Table 2).

When all healthcare visits were included, the rate of patient transfers was highest through the first three months on ART (IR 20.2 transfers per 100 visits, 95% CI 19.2, 21.2) and declined as time on ART increased (IR 15.7 transfers per 100 visits through 36 months on ART, 95% CI 15.1, 16.4; Fig. 2a). Within three months of starting ART, women had 1.22 times the rate of patient transfers compared to men. As time on ART increased, women were increasingly more likely to transfer than men (IRR 1.52, 95% CI 1.33, 1.72 through 36 months after ART initiation; Fig. 2b).

When analyses were restricted to recorded HIV visits only, the overall rate of patient transfers was lower than when all healthcare visits were included, but tended to increase with time on ART. For example, patient transfers increased through three to six months on ART (IR 7.5 transfers per 100 visits, 95% CI 6.8, 8.4), declined slightly through 12 to 24 months on ART, and peaked at 36 months after ART initiation (IR 9.7 per 100 visits, 95% CI 8.8, 10.8;Fig. 2c). In general, women remained more likely to transfer than men (Fig. 2d).

When all healthcare visits were included, the rate of patient transfers was relatively consistent across ART treatment eras (Fig. 3a). Women were more likely to transfer, including under Option B + (IRR 1.29, 95% CI 1.21, 1.37) and universal ART treatment (IRR 1.43, 95% CI 1.32, 1.55; Fig. 3b). When analyses were restricted to recorded HIV visits only, the rate of patient transfers increased in more recent ART treatment eras, although limited data was available from the universal test and treat era, leading to wide confidence intervals (Fig. 3c). Women remained more likely to transfer across all ART treatment eras, relative to men, although effect estimates were attenuated relative to when all healthcare visits were included (Fig. 3d).

Among all participants and all healthcare visits, 37% had at least one gap in care of > 180 days during the follow-up period (Table 3). The proportion of participants with a gap in clinical care increased to 51% when analyses were restricted to recorded HIV visits only. Gaps in clinical care did not vary meaningfully by gender (38% among women vs. 36% among men for all visits and 52% among women vs. 50% among for recorded HIV visits only). Approximately three-quarters of participants with at least one gap returned to care, regardless of whether all visits or only HIV visits were included. Among all return visits after a gap in care (n = 1499), 77% (n = 1155; 89% among HIV visits only) were to the same clinic attended prior to the gap, whereas 23% (11% among HIV visits only) were to a clinic different from the one previously visited, with no meaningful differences by gender.

Among all healthcare visits (n = 83,060), 2% (n = 1984) met the definition for a gap in care of > 180 days. Among visits when a patient transfer occurred, 5% of visits had a gap in care of > 180 days, compared to 2% of visits without a patient transfer. On average, at visits where a patient transfer occurred, participants were nearly three times as likely to have a gap in care of > 180 days (IRR 2.88; 95% CI 2.63, 3.16; (Table 4). Effect estimates for the association between patient transfers and gaps in care of > 180 days were stronger when analyses were restricted to recorded HIV visits only (IRR 3.06, 95% CI 2.83, 3.32). Regardless of whether all healthcare visits or only HIV visits were included, associations between patient transfers and gaps in care did not vary meaningfully by gender (All visits: IRR 2.90; 95% CI 2.61, 3.24 among women vs. IRR 2.82; 95% CI 2.36, 3.37 among men; HIV visits only: IRR 3.07; 95% CI 2.80, 3.37 among women vs. IRR 3.00; 95% CI 2.55, 3.52 among men).

Discussion

In a large HIV treatment cohort in South Africa, between one- and two-thirds of participants had at least one patient transfer over a median of nearly three years of follow-up, depending on whether all healthcare visits or only recorded HIV visits were included. When all healthcare visits were considered, patient transfers were more frequent than when only recorded HIV visits were considered and were highest at the time of ART initiation. When only recorded HIV visits were included, patient transfers tended to increase with time on ART. Regardless of whether all visits or recorded HIV visits were considered, patient transfers were typically more common among women than men. When all healthcare visits were considered, over a third of all participants experienced a gap in clinical care of over 180 days during the follow-up period, and this increased to over half when only recorded HIV visits were included. In both analyses, gaps in clinical care did not vary meaningfully by gender. Across analyses and, among all patients with a gap in care, over three quarters or more returned to care during the follow-up period. Visits in which patient transfers occurred were strongly associated with an increased likelihood of a gap in clinical care, for both women and men, regardless of whether all healthcare visits or recorded HIV visits were considered.

As access to universal ART scales up, PLWH are increasingly being asked to engage in lifelong HIV care in order to remain on ART and virally suppressed. To maintain sustained engagement in HIV care, PLWH need to be able to access HIV services at a healthcare facility that is convenient and accessible to them [26]. However, migration, patient preferences, stigma, poor treatment by staff, and health status may all play a role in patients choosing to transfer to a new facility [2, 3]. Our findings demonstrates that patient transfers between healthcare facilities among PLWH are common–in less than three years of follow-up, 31 to 65% of PLWH in this cohort transferred at least one time, with a median of two transfers among all participants when all healthcare visits were included. Estimates of patient transfers in our analysis include both formal and informal transfers for all healthcare visits and thus are higher than estimates from studies examining formal transfers for HIV care only [27–29]. In a separate study of PLWH engaged in care between 2002 and 2009, over a median follow-up of 2.5 years, only 13.2% of patients transferred formally, with the proportion of transfers increasing with more recent calendar year of enrollment.[29]

Including both formal and informal transfers for all healthcare visits may provide a more comprehensive picture of patient transfers over time for PLWH.

The time around ART initiation is well-documented to be a high-risk period for disengagement from HIV care [30–38]. Our findings including all healthcare visits indicated a higher rate of patient transfers close to the time of ART initiation and may suggest that participants initiating ART may also be at high-risk for transferring to a different facility. Patient transfers may be particularly high around the time of ART initiation among persons who have previously initiated ART, those seeking care further from their home to minimize potential stigma, those with transportation barriers, and among women transitioning to receiving ART outside of antenatal services postpartum [10, 29, 39–41]. When analyses were restricted to recorded HIV visits only, patient transfers increased slightly through three to six months on ART, again possibly indicating a high-risk period for patient transfers, and were highest through 36 months on ART. The high rate of patient transfers with more time on ART may reflect the increased likelihood of transferring over time (not just around the time of ART initiation) for persons living with HIV. Unfortunately, we have limited covariate information on PLWH in this cohort to examine differences in patient transfers by patient characteristics, including transitioning to ART care postpartum. However, in general, women were more likely than men to transfer through 36 months after ART initiation, regardless of whether all healthcare visits or only HIV visits were considered.

In this cohort, trends in patient transfers overall and by gender did not differ meaningfully across different ART treatment eras. However, very few PLWH in this cohort initiated ART in 2015 or 2016, when universal ART was being scaled up in South Africa [21, 22]. Thus, additional data on patient transfers from the era of universal ART is needed to understand how access to lifelong ART for all PLWH influences patient transfers over time.

Our findings suggest that patient transfers may be an important contributor to gaps in clinical care among PLWH on ART. In this cohort, 30–50% of all participants experienced at least one gap of over 180 days (6 months) in clinical care, with gaps in care being more likely when only HIV visits were considered. Three quarters of participants with a gap in care returned to care, with most returning to the clinic they visited prior to the gap in care. However, on average, visits where patient transfers occurred were associated with an approximately threefold increase in the likelihood of a gap in clinical care for both men and women in analyses including all healthcare visits and HIV visits only. These findings suggest that patient transfers may be a useful indicator of PLWH at high risk for disengagement from clinical care or gaps in ART access.

Our findings have a number of important strengths and limitations. Strengths include using comprehensive, linked electronic medical record data to quantify patient transfers by time from ART initiation and across changes in ART treatment guidelines. This analysis is also among the first to quantify patient transfers, including both formal and informal transfers, over time in a large cohort of PLWH and to examine whether visits with a patient transfer correlate with gaps in clinical care, both among all healthcare visits and recorded HIV visits only. Unfortunately, in these data we were unable to examine whether gaps in clinical care correlated with a higher risk of unsuppressed viral load or mortality in PLWH. We acknowledge as a limitation that analyses including all healthcare visits likely overestimate patient transfers and that analyses restricted to recorded HIV visits may underestimate patient transfers (due to not all HIV-related visits being indicated as such in administrative records). By including estimates including all healthcare visits and restricted to recorded HIV visits only, our analyses provide a range of plausible estimates for patient transfers over time and their association with gaps in clinical care. Additional limitations include the inability to stratify findings by official versus silent transfers or to identify indicated transfers, such as transfers among women from an antenatal clinical to an HIV clinic for ART services postpartum. We also had limited covariate information to control for potential confounders; however, our goal was not to estimate causal effects, but rather to describe patient transfers over time and examine if patient transfers are a useful indicator of gaps in clinical care. Given that we included both silent and official patient transfers across all healthcare visits, our estimates of patient transfers should be considered an upper limit. In addition, our data were not linked to the national population registry in South Africa and thus underestimate mortality. However, when estimating patient transfers and gaps in clinical care, we only examined time periods when participants were in care and thus alive. Finally, while PLWH typically receive a three to 6-month supply of ART, in some instances ART may be dispensed for longer, and we were unable to account for this in our analysis.

Conclusions

In this cohort of PLWH on ART in South Africa, one-third to two-thirds of participants transferred healthcare facilities at least once over a median of approximately three years of follow-up when only HIV visits and all healthcare visits were considered. In general, patient transfers were more common among women and around the time of ART initiation when all healthcare visits were considered, but tended to increase with time on ART in analyses restricted to HIV visits only. Throughout the follow-up period and across analyses including all or HIV-only visits, over a third of participants experienced a gap in clinical care of more than 180 days, and three-quarters of participants with a gap returned to care. Visits in which a transfer occurred were strongly associated with having a gap in clinical care, suggesting that patient transfers may be a useful clinical indicator of PLWH at high-risk for disengagement. These findings demonstrate that patient transfers among PLWH are common and may influence continuity in HIV care. More flexible strategies that accommodate patients moving between facilities, including digital health passports and strategies to make it easier to access care across a range of clinics, are urgently needed to improve continuity in HIV care and treatment outcomes for PLWH.

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Data Availability

Data for the present analysis come from the Provincial Health Data Centre of the Western Cape Department of Health and cannot be passed on to third parties without prior approval from the Provincial Health Data Center (https://www.westerncape.gov.za/general-publication/provincial-health-data-centre). Code for all analyses is available from Angela Bengtson (angela_bengtson@brown.edu).

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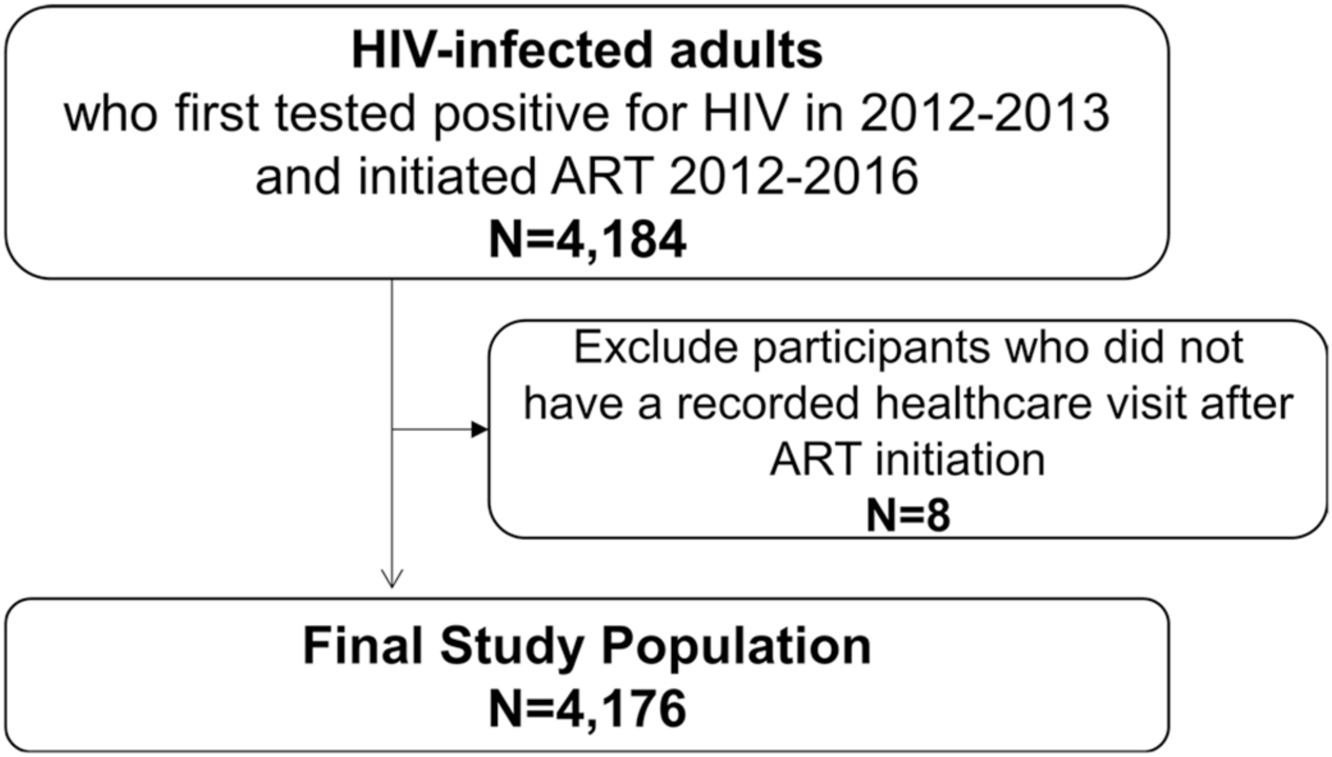

Fig. 1.
Study Population of adults living with HIV initiating antiretroviral therapy (ART) in a sub-district of Cape Town, South Africa 2012–2016

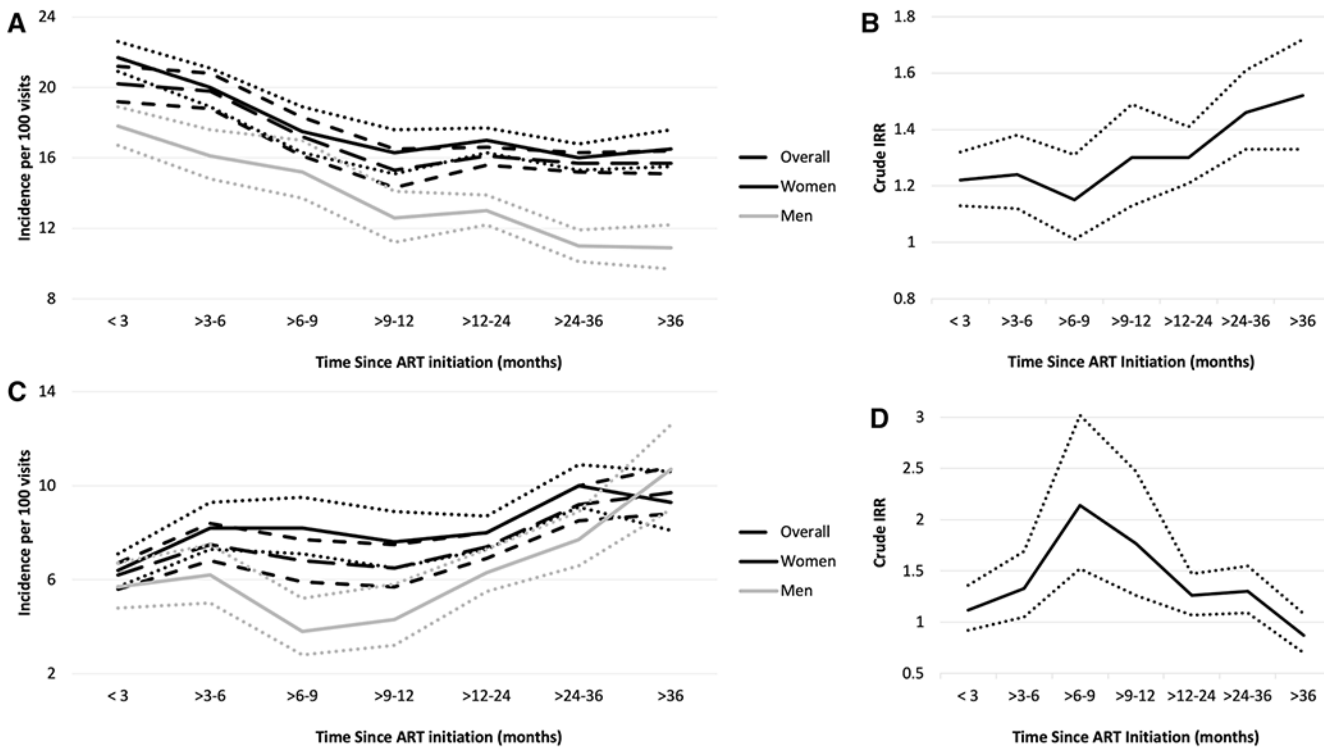

Fig. 2.

Panels A and C: Crude incidence rate[1,3] of patient transfers by time from ART initiation, overall and by gender. Panels B and D: Crude IRR and 95% CIs[2,4] of patient transfers comparing women to men. Panels A and B include all visits, whereas panels C and D include recorded HIV visits only. Dotted or short dashed lines represent 95% CIs. [1] Number of patient transfers over number of healthcare visits by time from ART initiation (all visits): < 3 months: 1,478/7,329; > 3–6 months: 1,446/7,316; > 6–9 months: 919/5,355; > 9–12 months: 770/5,022; > 12–24 months: 3,432/21,323 > 24–36 months: 3,296/20,976; > 36 months: 2,478/15,739. [2] Crude IRR, women vs. men (95% CI) by time from ART initiation (all visits): < 3 months: 1.22 (1.13, 1.32); > 3–6 months: 1.24 (1.12, 1.38); > 6–9 months: 1.15 (1.01, 1.31); > 9–12 months: 1.30 (1.13, 1.49); > 12–24 months: 1.30 (1.21, 1.41); > 24–36 months: 1.46 (1.33, 1.61); > 36 months: 1.52 (1.33, 1.72). [3] Number of patient transfers over number of healthcare visits by time from ART initiation (recorded HIV visits only): < 3 months: 495/8,045; > 3–6 months: 355/4,706; > 6–9 months: 213/3,154; > 9–12 months: 206/3,148; > 12–24 months: 736/9,930; > 24–36 months: 628/6,821; > 36 months: 354/3,632. [4] Crude IRR, women vs. men (95% CI) by time from ART initiation (recorded HIV visits only): < 3 months: 1.12 (0.92, 1.36); > 3–6 months: 1.33 (1.05, 1.69); > 6–9 months: 2.14 (1.52, 3.02); > 9–12 months: 1.77 (1.26, 2.47); > 12–24 months: 1.26 (1.07, 1.47); > 24–36 months: 1.30 (1.09, 1.55); > 36 months: 0.87 (0.70, 1.08)

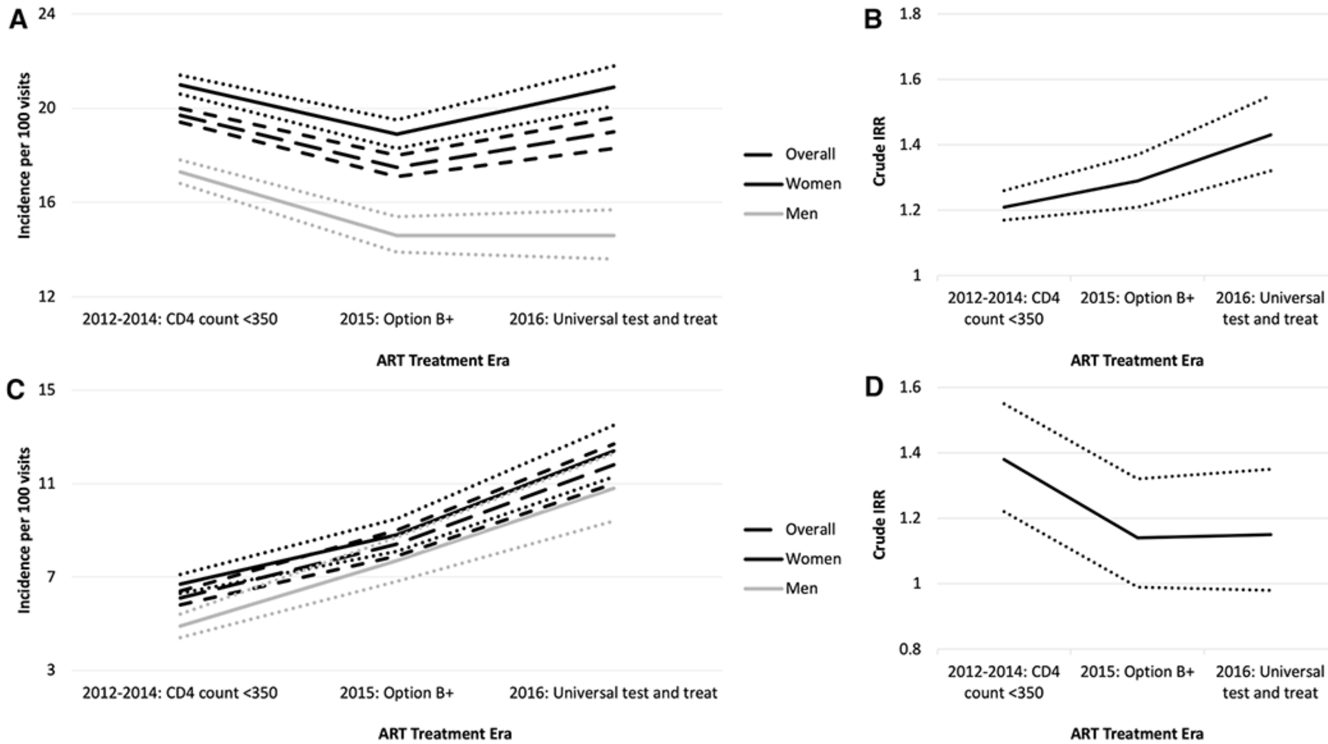

Fig. 3.

Panels A and C: Crude incidence rate[1,3] of patient transfers by ART treatment area, overall and by gender. Panels B and D: Crude IRR and 95% CIs[2,4] comparing women to men by ART treatment era. Panels A and B include all visits, whereas panels C and D include recorded HIV visits only. Dotted or short dashed lines represent 95% CIs. [1] Overall number of patient transfers over number of healthcare visits by ART treatment era (all visits): 2012–2014: 15,975/81,169; 2015: 5,217/29,775; 2016: 3,224/16,990. [2] Crude IRR, women vs. men (95% CI) by ART treatment era (all visits): 2012–2014: 1.21 (1.17, 1.26); 2015: 1.29 (1.21, 1.37); 2016: 1.43 (1.32, 1.55). [3] Overall number of patient transfers over number of healthcare visits by ART treatment era (recorded HIV visits only): 2012–2014: 1,383/22,783; 2015: 909/10,777; 2016: 695/5,876. [4] Crude IRR, women vs. men (95% CI) by ART treatment era (recorded HIV visits only): 2012–2014: 1.38 (1.22, 1.55); 2015: 1.14 (0.99, 1.32); 2016: 1.15 (0.98, 1.35)

Table 1

Demographic and clinical characteristics of HIV-infected adults who initiated ART at their first test positive for HIV between 2012 and 2013 in Cape Town, South Africa, overall and by patient transfer status

Characteristic at first HIV positive test	Never transferred	Transferred ≥ 1 time	All ART-initiators
	1446 (34.6)	2730 (65.4)	N = 4176
	N (%)	N (%)	N (%)
Gender			
Female	849 (58.7)	1,979 (72.5)	2828 (67.7)
Male	597 (41.3)	751 (27.5)	1348 (32.3)
Age, years			
15–19	21 (1.5)	69 (2.6)	90 (2.2)
20–29	401 (28.0)	1059 (39.7)	1460 (35.6)
30–39	583 (40.7)	980 (36.7)	1563 (38.1)
40–49	293 (20.5)	371 (13.9)	664 (16.2)
50–59	101 (7.0)	161 (6.0)	262 (6.4)
60 +	33 (2.3)	29 (1.1)	62 (1.5)
Year, first HIV + test			
2012	708 (49.0)	1410 (51.7)	2118 (50.7)
2013	737 (51.0)	1318 (48.3)	2055 (49.2)
2014	1 (0.07)	0 (0.0)	1 (0.02)
2015	0 (0.0)	2 (0.07)	2 (0.05)
Year, ART initiation			
2012	468 (32.4)	843 (30.9)	1311 (31.4)
2013	549 (38.0)	1222 (44.8)	1771 (42.4)
2014	182 (12.6)	379 (13.9)	561 (13.4)
2015	210 (14.5)	267 (9.8)	477 (11.4)
2016	37 (2.5)	19 (0.7)	56 (1.3)
CD4 count[a]			
≤ 200	385 (29.3)	720 (29.4)	1105 (29.4)
> 200–350	343 (26.1)	609 (24.9)	952 (25.3)
> 350–500	249 (19.0)	478 (19.5)	727 (19.3)

Characteristic at first HIV positive test	Never transferred	Transferred ≥ 1 time	All ART-initiators
	1446 (34.6)	**2730 (65.4)**	**N = 4176**
	N (%)	**N (%)**	**N (%)**
> 500	337 (25.6)	639 (26.1)	976 (26.0)

[a]Defined as within 3 months of first testing positive for HIV during the study period. Missing data among all participants: age n = 258 (3%), CD4 count n = 856 (10%); missing data among ART initiators: age n = 75 (2%), CD4 count n = 416 (10%)

Table 2

Patient transfers among adult living with HIV who initiated antiretroviral therapy in Cape Town, South Africa

	All visits			**Recorded HIV visits only**		
	Overall N = 4176	**Women N = 2828**	**Men N = 1348**	**Overall N = 3821**	**Women N = 2620**	**Men N = 1201**
Number of healthcare visits	83,060	55,418	22,642	38,436	26,542	12,894
Number of visits where a transfer occurred	13,819	9995	3824	2987	2151	836
% of visits where a transfer occurred	17%	18%	14%	8%	8%	6%
Number of patient transfers per person						
Median IQR	2 (0,4)	2 (0,5)	1 (0,4)	0 (0,1)	0 (0,1)	0 (0,1)
Range	0–48	0–32	0–48	0–26	0–26	0–24
% who transferred at least once	65%	70%	56%	31%	34%	26%
Days between most recent clinic visit and transfer						
Median IQR	17 (6, 39)	18 (7, 41)	14 (6, 33)	34 (13, 120)	35 (14, 128)	29 (11, 112)
Range	1–1411	1–1411	1–1370	1–1415	1–1411	1–1415
Days between transfer and next clinic visit						
Median IQR	18 (7, 38)	20 (7, 41)	15 (5, 31)	28 (14, 59)	29 (15, 59)	28 (11, 58)
Range	1–1411	1–1411	1–1187	1–1411	1–1411	1–888

Table 3

Gaps in care > 180 days among adult living with HIV who initiated ART in Cape Town, South Africa, including all healthcare visits and recorded HIV visits only

	All visits			Recorded HIV visits only		
	Overall N = 4176	**Women N = 2838**	**Men N = 1348**	**Overall N = 3821**	**Women N = 2620**	**Men N = 1201**
Participants with at least one treatment gap, n (%)	1560 (37%)	1081 (38%)	479 (36%)	1966 (51%)	1366 (52%)	600 (50%)
Among participants with at least one treatment gap						
Median number of treatment gaps (IQR)	1 (1,1)	1 (1,1)	1 (1,1)	1 (1, 2)	1 (1, 2)	1 (1, 2)
Range	1–4	1–4	1–4	1–4	1–4	1–5
Number (%) who return at least once	1180 (76%)	812 (75%)	368 (77%)	1409 (72%)	978 (72%)	431 (72%)
Total number of returns after a treatment gap	1499	1038	461	1938	1,344	594
To the same clinic	1155 (77%)	783 (75%)	372 (81%)	1725 (89%)	1,190 (89%)	535 (90%)
To a different clinic	344 (23%)	255 (25%)	89 (19%)	213 (11%)	154 (11%)	59 (10%)

Table 4

Associations between healthcare visits with a patient transfer and a gap in clinical care of > 180 days among adults living with HIV who initiated ART, overall and by gender

Characteristics	All visits			Recorded HIV visits only		
	Overall adjusted IRR (95% CI)[a]	Women adjusted IRR (95% CI)[a]	Men adjusted IRR (95% CI)[a]	Overall adjusted IRR (95% CI)[a]	Women adjusted IRR (95% CI)[a]	Men adjusted IRR (95% CI)[a]
Healthcare visits						
Among visits with no patient transfer	1.00	1.00	1.00	1.00	1.00	1.00
Among visits with a patient transfer	2.88 (2.63, 3.16)	2.90 (2.61, 3.24)	2.82 (2.36, 3.37)	3.06 (2.83, 3.32)	3.07 (2.80, 3.37)	3.00 (2.55, 3.52)
Year of ART initiation						
2012	1.00	1.00	1.00	1.00	1.00	1.00
2013	0.83 (0.75, 0.93)	0.85 (0.74, 0.97)	0.78 (0.65, 0.95)	0.85 (0.77, 0.94)	0.88 (0.78 0.98)	0.79 (0.66, 0.94)
2014	0.61 (0.52, 0.73)	0.65 (0.52, 0.79)	0.56 (0.42, 0.74)	0.82 (0.72, 0.94)	0.82 (0.70, 0.98)	0.82 (0.65, 1.04)
2015 or 2016	0.40 (0.31, 0.51)	0.40 (0.31, 0.53)	0.40 (0.24, 0.66)	0.45 (0.37, 0.55)	0.44 (0.35, 0.54)	0.51 (0.36, 0.73)
Age group, years						
20–29	1.00	1.00	1.00	1.00	1.00	1.00
16–19	0.52 (0.29, 0.95)	0.51 (0.27, 0.95)	0.67 (0.11, 4.20)	0.31 (0.14, 0.68)	0.24 (0.10, 0.62)	1.69 (0.91, 3.12)
30–39	0.91 (0.81, 1.03)	0.90 (0.79, 1.03)	1.06 (0.79, 1.41)	1.29 (1.16, 1.44)	1.31 (1.17, 1.46)	1.27 (0.94, 1.72)
40–49	0.87 (0.75, 1.01)	0.81 (0.67, 0.98)	1.07 (0.80, 1.45)	1.53 (1.35, 1.74)	1.51 (1.30, 1.76)	1.56 (1.17, 2.15)
50–59	0.71 (0.58, 0.87)	0.65 (0.50, 0.85)	0.89 (0.62, 1.28)	1.30 (1.09, 1.55)	1.23 (0.98, 1.55)	1.41 (0.99, 2.00)
60 +	0.41 (0.24, 0.69)	0.33 (0.16, 0.67)	0.57 (0.27, 1.22)	1.44 (1.06, 1.94)	1.17 (0.76, 1.82)	1.79 (1.13, 2.83)
Gender						
Female	1.00	–	–	1.00	–	–
Male	0.96 (0.86, 1.07)	–	–	0.83 (0.76, 0.92)	–	–

IRR incidence rate ratio

[a] Adjusted for: age (modeled as a categorical variable), year of ART initiation, and gender (for overall estimate only)