

Factors associated with opting care from closer location to residence among PLHIV at Andhra Pradesh, India between 2023 and 2024

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Title: Factors associated with opting care from closer location to residence among PLHIV at Andhra Pradesh, India between 2023 and 2024

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Abstract

Background:

Decentralization of antiretroviral therapy (ART) services is a key component of differentiated service delivery models to improve access and retention among people living with HIV (PLHIV). In Andhra Pradesh, India, many PLHIV continue to travel long distances for ART refills despite the availability of services at decentralized facilities. This analysis describes PLHIV preferences for decentralized ART services and the treatment outcomes.

Methods:

From October 2022 to April 2023, staff from 53 ART centers in Andhra Pradesh identified and systematically contacted PLHIV traveling more than 50 km to collect ART. Using a standard script, PLHIV were offered the option to receive care at decentralized facilities closer to their residence. We estimated the proportion of PLHIV opting for decentralized care and used modified Poisson regression with robust standard errors to identify factors associated with uptake, reported as adjusted relative risks (aRR). Retention in care over 12 months was compared between those receiving decentralized care and those continuing care at distant facilities using Kaplan-Meier methods.

Results:

Among 213,375 PLHIV alive in care, 20,761 (9.7%) traveled >50 km for ART access. Of the 18,418 (88.7%) who were contacted, 8,877 (48.2%) opted for decentralized ART care (care closer to residence); however, only 6,639 (74.8%) reached the decentralized facility. Uptake was higher among females (aRR: 1.10; 95% CI: 1.07–1.14), those on ART for ≤ 3 years (aRR: 1.23; 95% CI: 1.19–1.28), and individuals with prior loss to follow-up, including <3 interruptions (aRR: 1.17; 95% CI: 1.13–1.21) and ≥ 3 interruptions (aRR: 1.27; 95% CI: 1.22–1.32). At 12 months, retention was slightly higher among those receiving decentralized care (96.5%; 95% CI: 96.1–96.9) compared with those

continuing care at distant facilities (95.2%; 95% CI: 94.8–95.7), with lower loss to follow-up (2.3% vs 3.6%), while mortality was similar (1.2% in both groups). Common reasons for declining closer care included access to co-located health services (37%), perceived anonymity (29%), proximity to workplace (13%), staff familiarity (10%), and self-perceived stigma (5%).

Conclusion:

PLHIV choice with decentralized ART delivery improved retention modestly without compromising mortality, while highlighting the need to address stigma, anonymity, and integrated service access when expanding decentralized care. Strengthening person-centered models may enhance service efficiency and equitable access to HIV care and treatment.

Keywords: decentralization, differentiated care, treatment interruption, retention, viral load suppression, health service access.

Introduction:

Ensuring continuous access to antiretroviral therapy (ART) is critical to achieving the global 95-95-95 HIV targets¹. To improve treatment adherence and reduce barriers to care, India's National AIDS Control Programme (NACP) has prioritized differentiated service delivery models (DSDMs), including multi-month dispensing, same-day ART initiation, and decentralized ART refills². Despite these strategies, missing ART clinic appointments and loss to follow-up persist, often driven by long travel distances, transportation costs, waiting times, and fear of stigma.^{3,4,5}

Person-centered care through the decentralization of ART services to peripheral health facilities has been instrumental in bringing services closer to people living with HIV (PLHIV) and reducing the travel and financial burden of accessing care. However, proximity alone may not fully determine service preference. Prior studies indicate that PLHIV deliberately seeks ART services outside their residential catchment area to reduce the risk of being recognized and to prevent unintended HIV-status disclosure within their community^{6,7} reflecting stigma-avoidance and confidentiality concerns⁸. While decentralized services closer to one's residence may reduce structural barriers⁹, this option may simultaneously heighten concerns related to perceived or anticipated stigma, particularly in smaller or close-knit communities.^{9,10} In this regard, decentralization can create a strain between convenience and privacy, as services closer to home may increase concerns about confidentiality and stigma; addressing this trade-off is central to person-centered HIV care.^{11,12}

Andhra Pradesh (AP), a southern Indian state with an adult HIV prevalence of 0.62%¹³. Although ART services are widely available in peripheral health

facilities, many PLHIV continue to travel long distances from their residence to tertiary or secondary hospitals. India's National HIV treatment guidelines are in alignment with the global guidelines¹⁴ in recommending decentralized ART services in the sub-district peripheral hospitals as a part of person-centered care for stable PLHIV². Majority of decentralized facilities lack the capacity to manage complications, increasing the risk of morbidity, mortality, and drug resistance if care is fragmented.

Despite national HIV guidelines promoting decentralized ART, program data from October 2022 in A.P showed that among PLHIV lost to follow up, approximately two-thirds were residing more than 50 km from the facility where they received ART. To address missed appointments, retention and increase choice in care delivery, the Andhra Pradesh State AIDS Control Society (APSACS) which is the primary implementer of the National AIDS Control Program in A.P, in collaboration with the U.S. Centers for Disease Control and Prevention (CDC) and SHARE INDIA, implemented an initiative to offer stable PLHIV the option to transfer to decentralized care closer to their residence.

We describe the implementation process and early outcomes of the decentralized ART initiative in Andhra Pradesh. Specifically, we report the proportion of PLHIV who opted for decentralized care, analyzed characteristics associated with this decision, and compared 12-month retention and lost to follow-up (LFU) rates between those who opted for decentralized care and those who continued to access care from their original, more distant facility.

Methods

This is an observational cohort study based on routine program data collected by the ART centre staff in the program records (treatment register, treatment card and NACP electronic database). AP has a well-established public sector ART service delivery system established by the National AIDS Control Organization within the existing hospitals of general health system comprised

of 53 ART centers (hubs) and 139 linked ART centers (spokes) providing HIV care and treatment. . These ART centers are located within public health facilities and are staffed multidisciplinary teams including a trained physician, nurse, pharmacist, counsellor, data manager, lab technician and a community representative.

During October 2022-April 2023, we identified PLHIV traveling >50 km from their residence to the ART centers from the program records and NACP electronic database. As per India's National Guidelines, only stable PLHIV were eligible to be offered decentralized ART services¹⁵. Stable PLHIV are defined as being on ART for at least six months, having no current opportunistic infection or medical condition requiring close clinical monitoring, no significant ART-related adverse effects, and having a suppressed viral load (<1,000 copies/ml). Unstable PLHIV include those with advanced HIV disease, treatment failure, poor adherence, or significant comorbidities, and thus were not recommended to be linked to decentralized facilities since they require frequent clinical review, specialist observation, or rapid treatment modifications available only at higher-level facilities¹⁶.

Eligible individuals, including parent or guardians of children under 18 years, were contacted either telephonically or during routine pill pick-up visits and were counselled using a standard script, on the availability and potential benefits of accessing ART services at decentralized facilities closer to their residency. Information on patient choice (opting for decentralized care or continuing at the current facility), date of consent, pill-pick details, and the name of the referring facility were recorded in the routine program records. There are no additional records used for study purposes.

Among PLHIV who opted for decentralized care, ART staff reviewed whether they were due for routine annual investigations, including an HIV viral load test and whether they have completed TB preventive therapy (TPT) prior to referral. PLHIV needed to have completed all investigations and TPT prior to opting into decentralized care. The index date was defined as the date on

which the individual opted for decentralized ART care closer to their residence or chose to continue care at the distant facility. PLHIV agreeing to receive care at the decentralized facility were provided with a referral slip and an ART refill with instructions to present at the decentralized site within 28 days.

PLHIV who reached the decentralised facility or who continued care at the distant facility were followed up for 12 months from date of reporting to assess the outcome. Outcome analyses were based on actual receipt of care, and PLHIV who opted into but did not report to decentralized facilities were excluded. Per the program guidance, reasons of PLHIV not wanting to take ART refill services at the decentralized facility closer to their residence were documented and analysed.

Operational Definitions:

Reached decentralised facility: PLHIV who had opted for decentralized care at a location closer to residence and reported to the decentralized facility within 28 days from the index date.

Continued care at distant facility: PLHIV who opted to remain receiving ART care from their existing distant facility located more than 50 km from their place of residence.

Lost to follow-up (LFU): Treatment interruption for more than 28 days from the last pill-pick-up appointment date.

Data collection, data management and analysis: Routine program data was collected from the standard program records maintained at the ART center including treatment registers, treatment cards, and the NACP electronic database. Variables such as age, sex assigned at birth, duration of ART, prior history of LFU and reasons for opting for care from distant ART facilities that are located more than 50 km from residence. CD4 and viral load was available but not included in regression analyses as eligibility for decentralization was restricted to clinically stable PLHIV per national guidelines. All data were entered into Microsoft Excel (Version MSO 16.0.10383.20027). We calculated

the median, inter-quartile range (IQR) for continuous variables, and proportions for categorical variables. We categorized the responses into two categories (i) opted for decentralized care (<50 km) to residence and (ii) not agreeing decentralized care. We calculated the proportions for each category. Further we classified the single response reasons for not accepting the option for closer ART care (i.e. opted to continue from distant location) based on personal reasons including family members accessing services at same facility, place of work or education, co-location of other services in the same hospital and perceptions (stigma and anonymity). We hypothesized that the reasons for not opting for decentralized care would differ by age group and hence disaggregated the data by age (Table 3).

The primary outcome was opting for decentralized ART care (yes/no). The independent variables of interest included age group, sex, duration on ART, and prior history of LFU, selected a priori based on programmatic relevance and existing evidence on factors influencing engagement in HIV care. As decentralized care was offered only to clinically stable PLHIV, variables such as rural-urban residence, type of facility, viral load, and CD4 count were not included in the analysis, as these characteristics were relatively uniform within the eligible population and did not provide meaningful comparison. Modified Poisson regression with robust standard errors was used to estimate adjusted relative risks (aRR) and 95% confidence intervals for factors associated with opting for decentralized care (Table-1). This approach was chosen because the outcome was common (>10%), and odds ratios from logistic regression may overestimate associations. All variables were included in the model based on conceptual relevance rather than statistical selection procedures.

Differences in the proportion of retention and loss to follow-up at 12 months between those receiving decentralized care and those continuing care at distant facilities were compared using the chi-square test (Table 2).

Time-to-event analysis was conducted using Kaplan–Meier methods to estimate retention in ART care over 12 months by decentralization status,

with loss of retention defined as death or LFU (>28 days missed pill pick-up); individuals retained in care at 12 months were censored. Follow-up time was defined from the start of care under the selected model: the date of first ART collection at the decentralized facility for those who opted for decentralized care, and the date of decision to continue care at the distant facility for those who did not opt for decentralized care. Survival curves were compared using the log-rank test (Figure 1). We analyzed data using IBM SPSS Statistics for Windows (Version 23.0).

Results:

From 213,375 PLHIV alive in care during October 2022, we generated a list of 20,761 (9.7%) PLHIV travelling >50 km for ART pill pick-up from 53 ART centers (hubs) and 139 link ART centers (spokes) in AP. Of the 20,761, 18,418(88.7%) were successfully contacted either by telephone (n=12,770) or in-person (n=5,648). Overall, 8,877(48.2%) opted for decentralized care. Among those who agreed for decentralized care, 6,639 (74.8%) reached the decentralized facilities, while 2,238 (25.2%) did not report to the decentralized facility and continued care at the original, distant facility.

Of those who agreed to receive decentralized care closer to their residence, 50% (4,788) were female, and the median age was 42 years (IQR: 35–50). In multivariable analysis using modified Poisson regression, PLHIV on ART for ≤ 3 years were more likely to opt for decentralized care compared with those on ART for >3 years (aRR: 1.23; 95% CI: 1.19–1.28). Females were more likely to opt for decentralized care than males (aRR: 1.10; 95% CI: 1.07–1.14). Compared with individuals aged <20 years (reference), those aged ≥ 60 years were more likely to opt for decentralized care (aRR: 1.18; 95% CI: 1.07–1.30), while younger age groups (20–39 & 40–49 years) showed no significant difference. Additionally, PLHIV with a history of prior loss to follow-up were more likely to opt for decentralized care compared with those with no prior interruption, including those with <3 prior interruptions (aRR: 1.17; 95% CI:

1.13-1.21) and ≥ 3 prior interruptions (aRR: 1.27; 95% CI: 1.22-1.32) (Table 1).

Table-1: Factors associated with PLHIV opting care from closer location to their residence, Andhra Pradesh, India-2023-2024 (N=18,418)

Characteristics	PLHIV Travelling >50 Km n=18,418	Opted for decentralized care n = 8,877 (%)	P Value	Crude Risk Ratio (RR)	95% CI	P Value	Adjusted Risk Ratio (aRR)	95% CI
Age (years)								
<20	643	297 (46.2)		Ref				
20-39	6,640	3,200 (48.2)	0.339	1.04	0.96 - 1.14	0.475	1.03	0.95-1.13
40-59	9,907	4,737 (47.8)	0.430	1.04	0.95-1.13	0.134	1.07	0.98-1.16
≥ 60	1,228	643 (52.4)	0.013	1.13	1.03-1.25	0.001	1.18	1.07-1.30
Sex								
Female	9,576	4,788 (50)	<0.001	1.08	1.05-1.11	<0.001	1.10	1.07-1.14
Male	8,842	4,089 (46.2)		Ref				
Duration on ART (years)								
≤ 3	3,808	2,155 (56.6)	<0.001	1.23	1.19-1.27	<0.001	1.23	1.19-1.27
>3	14,610	6,722 (46)		Ref				
History of LFU								
No interruption	10,883	4,842 (44.5)		Ref				
LFU <3 times	4,670	2,422 (51.9)	<0.001	1.17	1.13-1.21	<0.001	1.17	1.13-1.21
LFU ≥ 3 times	2,865	1,613 (56.3)	<0.001	1.27	1.22-1.32	<0.001	1.27	1.22-1.32

Of the 8,877 who agreed for decentralized care, 74.8% (n=6,639) reached the preferred decentralised facility. At 12 months, 6,407 (96.5%) were retained in care, 150 (2.3%) were LFU and 82 (1.2%) had died. (Table-2). Among those who continued care at distant facilities (n=9,541), 9,086 (95.2%) were retained in care at 12 months while 343 (3.6%) were lost to follow-up and 112 (1.2%) died.

Table-2: Cascade of PLHIV Opting for decentralized ART versus at a Distant Location Over 50 Km, AP India 2023-2024

PLHIV travelling > 50 Km	20,761		
PLHIV contacted to provide option for decentralized care	18,418 (88.7%)		
Opted for care from distant location	9,541		
Opted for decentralized care	8,877		
Did not reach decentralized facility	2,238*		
Reached decentralized facility	6,639 (74.8%)		
Status of the PLHIV at 12 months	Receiving Decentralized Care (n=6,639)	Continued care from distant facility (n=9,541)	p value
Retained in care	6,407 (96.5%)	9,086 (95.2%)	0.0001
LFU	150 (2.3%)	343 (3.6%)	
Died	82 (1.2%)	112 (1.2%)	

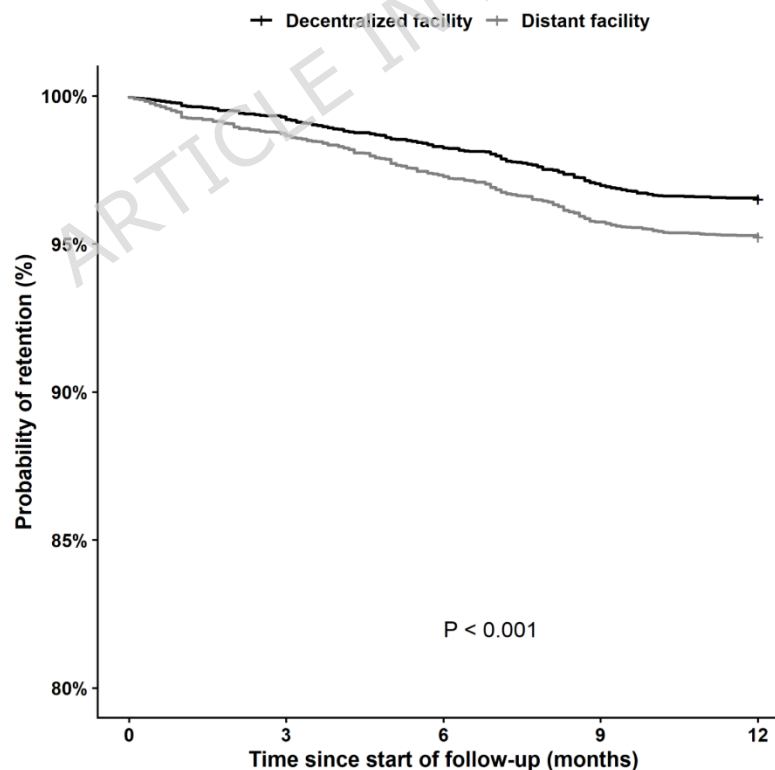
*** Excluded from outcome analysis**

Sensitivity analyses excluding PLHIV who initially agreed to decentralization but did not report to decentralized facilities showed minimal change in the observed associations.

These findings suggest that decentralized ART care was associated with modestly improved retention, primarily driven by lower loss to follow-up, while mortality remained similar between groups.

Participants were followed for up to 12 months after initiation of care under their selected care location. Kaplan-Meier analysis showed that the probability of remaining retained in care was high in both groups over the follow-up period. At 12 months, survival was slightly higher among those receiving care from the decentralized facilities (96.5%, 95% CI: 96.1–96.9), compared with those who continued care at distant facilities (95.2%, 95% CI: 94.8–95.7), and the difference was statistically significant (log-rank $p < 0.001$). (Figure 1)

Figure1: **Annual Probability of retention in care among PLHIV based on care at decentralized or distant facility, Andhra Pradesh**



Of the 18,418 PLHIV contacted, 9,541 (51.8%) opted not to access ART from a decentralized facility closer to their residence. Reasons for not opting for closer care included benefit of availing other interdepartmental co-located health services in the current location (n=3,548; 36.5%), while 28.6% (n=2,778) cited anonymity and 13.1% cited proximity to workplace (n=1,250). Other reasons included ART staff familiarity (n=980; 10.3%), family member accessing ART in same facility (n=264, 2.2%), reported self-perceived stigma (n=507; 5.2%) and other reasons (n =214, 2.1%).

Reasons for not opting for closer care varied by age group. Among individuals aged <20 years, 6.1% reported having a family member accessing services at the same facility. Among people less than 20 years (40.8%) and among older PLHIV older than 60 years (41.9%) the availability of co-located services was the preferred reason to remain at the more distant facility. In contrast, 30.9% of PLHIV aged 20–39 years cited perceived loss of anonymity at decentralized facilities, and 17.6% of children and adolescents reported that their place of work or education was closer to the more distant facility. (Table 3).

Table 3: Reasons for not opting for decentralized care, Andhra Pradesh, India-2023-2024

Reasons for not opting decentralized care	PLHIV not opting for decentralized care (n= 9,541)	Age in years			
		<20 n (%)	20-39 n (%)	40-59 n (%)	≥60 n (%)
Availability of co-located services	3,548	141 (40.8)	1,253 (36.4)	1,909 (36.9)	245 (41.9)
Perceived anonymity	2,778	73 (21.1)	1,063 (30.9)	1,505 (29.1)	137 (23.4)
Place of work/ study	1,250	61 (17.6)	416 (12.1)	670 (13.0)	103 (17.6)
ART staff familiarity	980	20 (5.8)	357 (10.4)	551 (10.7)	52 (8.9)

Perceived stigma	507	17 (4.9)	175 (5.1)	288 (5.6)	27 (4.6)
Family member accessing services at same facility	264	21 (6.1)	87 (2.5)	148 (2.9)	8 (1.4)
Others	214	13 (3.8)	89 (2.6)	99 (1.9)	13 (2.2)
Total	9,541	346 (3.6)	3,440 (36.1)	5,170 (54.2)	585 (6.1)

Discussion:

Decentralization of antiretroviral therapy (ART) services is a key component of differentiated service delivery to improve access and retention among PLHIV. Through this large, programmatic intervention we report that decentralization of ART services, when offered as a voluntary, person-centered option, was acceptable to approximately half of PLHIV traveling long distances for care in Andhra Pradesh. Uptake was higher among females, those on ART for shorter duration, and individuals with prior treatment interruptions. While retention remained high among people who opted into decentralized care and among those who remained at the more distant facility, PLHIV who chose decentralized ART services experienced modestly lower rates of loss to follow-up over 12 months. Availability of service co-location and anonymity impacted the decision not to opt for decentralized care services closer to the residence.

Our findings underscore that distance alone does not determine ART service preference. Among PLHIV, who declined decentralised care, access to co-located services at higher-level facilities emerged as the most frequently cited reason. This preference reflects the perceived value of integrated care, continuity with familiar providers, and access to ancillary and specialist services, factors that have been consistently reported in other settings from Uganda³ and South Africa⁹. These studies also have similarly shown that

PLHIV often travel longer distances to access tertiary or secondary facilities because of broader service availability and established patient-provider relationships, even when closer options exist.

Loss to follow-up was lower among those receiving decentralized care (2.3% vs 3.6%), while death rates were the same in both groups (1.2% each). This suggests that decentralization may help to reduce disengagement from care and supports continuity of treatment. Concerns related to anonymity and stigma were also prominent and varied by age group. In this context, anonymity reflects anticipated or perceived stigma, whereby PLHIV intentionally seek care outside their residential catchment areas to reduce the risk of recognition and inadvertent HIV-status disclosure. Nearly one-third of adults aged 20–39 years cited anonymity as a key reason for declining decentralized care, consistent with findings from Tanzania¹⁷ and Nigeria¹⁸, where travelling farther for care was described as an enabling strategy to maintain confidentiality and mitigate stigma. These findings highlight a central tension in decentralised service delivery: while bringing services closer can reduce structural barriers such as travel time and cost, it may simultaneously heighten concerns about privacy in smaller or socially interconnected communities.

Age-stratified analyses further illustrate how service preferences differ across the life course. Younger PLHIV (<20 years) more frequently reported alignment with family members' care locations and proximity to educational institutions, while older PLHIV (≥60 years) prioritised co-located services, likely reflecting greater healthcare needs related to comorbidities. These patterns reinforce that decentralized care strategies must be responsive to the overall client needs and preferences. Evidence from Malawi¹⁹ and other resource-limited settings indicates that shorter travel distance is associated with improved retention; however, our findings suggest that the benefits of proximity may be offset when concerns related to stigma, anonymity, or service fragmentation are not addressed. We report modest differences in

retention between the decentralized and non-decentralized groups, suggesting that decentralization alone is not a panacea for disengagement from care. Importantly, this study adds new insight by demonstrating that offering choice itself, rather than mandating decentralization, may support engagement by encouraging individuals to access care in settings that meet their specific needs and comfort level.

Our findings suggest that systematic messaging on facility location and benefits of decentralised ART care may benefit a subset of people. While planning differentiated service delivery of decentralised care, opportunities for interdepartmental and collaborative care services at the decentralised facilities may be considered for increased uptake²⁰. Additionally, to improve uptake of decentralized care, prior sensitization of the staff at the proposed decentralised facilities may be considered as a prerequisite to mitigate stigma and discrimination.^{21,22}

Limitation: Decentralization was voluntary and restricted to stable PLHIV, as per National Guidelines, which introduces the potential for self-selection bias. Although multivariable models adjusted for key covariates (age, sex, duration on ART, and prior loss to follow-up), residual confounding is likely as comorbidities, occupation, were not consistently captured in routine program data. The study relied on routinely collected data from program records, which may be subject to incomplete documentation, misclassification, and variability in data quality across facilities. In addition, a proportion of PLHIV who initially agreed to decentralization did not subsequently report to the decentralized facility and were therefore excluded from the decentralized care outcome analysis; although sensitivity analyses suggested minimal impact on observed associations, this may limit generalizability.

Retention outcomes were assessed over a 12-month period, and longer-term effects of decentralization on sustained engagement, viral suppression, and clinical outcomes could not be evaluated. Despite these limitations, the statewide scope, large sample size, and real-world implementation context

provide valuable insights into patient preferences and operational considerations for decentralized ART delivery in India.

Conclusion

The Andhra Pradesh experience shows that decentralizing ART services can modestly improve treatment retention while offering clients greater flexibility and choice in accessing care. However, a person's decision to opt into decentralized care extends beyond distance to the facility. To achieve the full potential of differentiated service delivery, decentralization efforts should be accompanied by ongoing efforts to enhance communication and training among staff to mitigate stigma and expand service integration.

List of abbreviations

Abbreviations

ART	Antiretroviral Therapy
PLHIV	People Living with HIV
AP	Andhra Pradesh
APSACS	Andhra Pradesh State AIDS Control Society
DSDM	Differentiated Service Delivery Model
NACP	National AIDS Control Programme
MMD	Multi-Month Dispensing
LFU	Lost to Follow-Up

Declarations

Ethics approval and consent to participate: Since all elements of the study are a part of the differentiated service delivery model of care and is a part of the national guidelines the government of Andhra Pradesh considered this analysis as a routine program activity and did not require ethical approval. There were no identified risks beyond those involved in routine HIV care for participation in this study. This study was reviewed and approved by Science Integrity Branch of the U.S Centers for Disease Control and Prevention (CDC) and was conducted consistent with human subjects' research protections applicable U.S. federal law and CDC policy (See e.g., 45 C.F.R. part 46, 21 C.F.R. part 56; 42 U.S.C. §241(d); 5 U.S.C. §552a; 44 U.S.C. §3501 et seq). The analysis was conducted on humans and/or human data, or material are in compliance with the Helsinki Declaration.

Consent to Participate: As routine program requirement consent was taken from PLHIV as the care provided is a standard of care under national program.

Consent for publication: Not Applicable

Availability of data and materials

There are ethical and legal restrictions on sharing the de-identified data set. As these data are related to PLHIV containing sensitive information, there are restrictions as per the National law (HIV prevention and control act, 2017). The corresponding author can be reached by email for data request.

Competing interests: The authors declare no competing interests.

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Authors' contributions:

RA, KP, PK conceived the study; RA, PK, NC, MT designed the project protocol; PK, RG, JK, RP, AR developed data collection tools. RA, NC, PK, JK, MT, MN, PT analyzed and interpreted the data; RA, JK, VY, MN drafted the manuscript; All authors critically reviewed the manuscript for important intellectual content. All authors read and approved of the final manuscript. KP is the guarantor of the paper.

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CDC Disclaimer

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the funding agencies.

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