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Loss to follow-up and its predictors among children living with HIV on antiretroviral therapy, southern Oromia, Ethiopia: a 5-year retrospective cohort study

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ABSTRACT

Background Loss to follow-up (LTFU) among paediatric patients living with HIV presents a significant challenge to the global scale-up of life-saving antiretroviral therapy (ART).

Objectives This study aims to estimate LTFU incidence and its determinants among children with HIV on ART in Shashemene town public health institutions, Oromia, Ethiopia.

Design A retrospective cohort study from 1 January 2015 to 30 December 2020.

Setting This study was conducted in Shashemene town, Oromia, Ethiopia.

Participants Medical records of 269 children receiving ART at health facilities in Shashemene town were included.

Methods Data from patients' medical records were collected using a standardised checklist. EpiData V.3.1 was employed for data entry, while Statistical Package for the Social Sciences (SPSS) V.25 facilitated analysis. The Kaplan-Meier survival curve was used for estimation of survival time. To measure association, adjusted HRs (AHRs) with 95% CIs were calculated. Both bivariable and multivariable Cox proportional hazards regression models were employed to identify predictors of LTFU.

Results Of the 269 children living with HIV included in the final analysis, 43 (16%) were lost to follow-up. The overall incidence rate of LTFU was 3.3 (95% CI 2.4 to 4.4) per 100 child-years of observation. Age less than 5 years (AHR 0.03, 95% CI 0.00 to 0.36), non-orphan status of the child (AHR 0.13, 95% CI 0.05 to 0.34), < 30 min distance to health facility (AHR 0.24, 95% CI 0.08 to 0.73), disclosed HIV status (AHR 0. 32, 95% CI 0.13 to 0.80), history of opportunistic infection (AHR 3.54, 95% CI 1.15 to 10.87) and low CD4 count (AHR 5.17, 95% CI 2.08 to 12.85) were significant predictors of LTFU.

Conclusion The incidence rate of LTFU was lower compared with other studies in Ethiopia. This result indicated that age less than 5 years, non-orphans, low CD4, disclosed HIV status and distance from health facility were predictors of LTFU.

STRENGTH AND LIMITATION OF THE STUDY

⇒ This study having been conducted at different healthcare institutions (two hospitals and one health centre) could increase the generalisability of the findings to all healthcare institutions in the area.
⇒ The study was conducted over an extended period of time (5 years) which increases observation time.
⇒ There are limited data on possible key predictors of loss to follow-up (LTFU) such as viral load, immunisation status and nutritional factors (biochemical, clinical and dietary) of the child.
⇒ Exclusion of incomplete data might have underestimated or overestimated this result.
⇒ This study used secondary data and was unable to determine the cause and outcome of LTFU.

INTRODUCTION

The most serious HIV and AIDS epidemic in the world is in sub-Saharan Africa. In 2019, an estimated 25.7 million people were living with HIV, accounting for 67.6% of the global total.[1] In the same year, there were an estimated 9% new HIV infections among children, with 84% infections occurring in sub-Saharan Africa.[2] There were 1.8 million children living with HIV around the world.[2 3]

In Ethiopia, according to the UNAIDS 2019 report, 44 000 children were living with HIV/AIDS and there were 2100 AIDS-related deaths among children younger than 15 years of age.[4] Based on the new spectrum estimate for 2017, antiretroviral therapy (ART) coverage for adults (age >15 years) has reached 75% but the coverage remains low (34%) for children (age <15 years) living with HIV in Ethiopia.[4] Loss to follow-up (LTFU) is a major challenge for the global scale-up of life-saving ART.[5] It is a considerable obstacle for the effectiveness of the ART programme which negatively impacts on the immunological benefits of ART,[6] results in treatment failure due to poor adherence, increases AIDS-related morbidity and mortality,[7] and also increases drug toxicity and drug resistance.[8] Children are more vulnerable than

adults to being LTFU because they do not gain access to healthcare services without caregivers.[9]

The estimated proportion of LTFU among children varies across the globe. In Brazil, the proportion of LTFU is 14% and 28% after undergoing 1 year and 2 years treatment, respectively.[5] In low-income countries such as those in Asia and Africa, it was found that at 18 months after the initiation of ART, 12.3% were LTFU.[10] LTFU is much greater in East Africa (14%) compared with Asia (4.1%).[10] According to the International Epidemiologic Databases to Evaluate AIDS global cohort in sub-Saharan Africa, the incidence of LTFU was reported to be 26%.[11] In Ethiopia, the incidence of LTFU ranges from 17.1%[12] to 34%.[13]

LTFU is defined as not taking an ART refill for three or more consecutive appointments from the last attendance for refill and not yet classified as 'dead' or 'transferred-out' based on the WHO patient monitoring guideline for HIV care and ART.[14] There have been a number of interventions in place around the world to improve adherence to treatment. WHO also recommends that age-appropriate disclosure and regular support from caregivers are essential to improving adherence to ART.[15] The Orphans and Vulnerable Children (OVC) programme in Africa, in collaboration with healthcare workers, is working tirelessly to trace people who have been lost to HIV care.[4] In Ethiopia, the government has implemented telephone-based adherence support, simplified administrative approaches and decentralised service delivery.[16]

Previous studies identified determinants of LTFU like poor/fair medication adherence,[8] WHO clinical stage 3/4 and regimen substitution,[17 18] low CD4 cell counts,[13 17] weight-for-age z-scores below −4 and age<5 years, sex,[19] age<1 year,[13] type of caregiver,[18] and the distance from facility.[20] However, all of these studies didn't include WHO recommendations like age-appropriate disclosure status despite the fact that disclosure status is significantly associated with the length of the follow-up period.[21] The determinants may also vary from place to place depending on socioeconomic status and cultural context.

There is a paucity of evidence on the incidence and determinants of LTFU in the paediatric age group. This study provides valuable information for the design and implementation of retention mechanisms critical to reducing HIV morbidity and mortality, reducing new infections among children, and reducing the development of ART resistance. Therefore, the aim of our study was to determine the incidence and determinants of LTFU among children living with HIV who are on ART in the southern part of Oromia, Ethiopia.

METHODS

Description of study area and population

This retrospective cohort study was conducted in public health facilities situated in Shashemene town, which maintained follow-up records from 1 January 2015 to 30 December 2020. These facilities comprised two hospitals and four health centres, collectively serving a total of 596 children receiving ART and offering ART services since 8 February 2006, as reported by the town Health Office Statistics in 2017. Data collection took place from 5 April 2021 to 26 April 2021.

The study included children under the age of 15 years who had at least one follow-up visit and complete baseline records. Participants with no follow-up visits, incomplete baseline data or lost records were excluded. All records of children living with HIV on ART follow-up from 1 January 2015 to 30 December 2020, were considered, resulting in 272 individuals meeting the eligibility criteria (online supplemental figure 1).

Study variables

Dependent variables

LTFU is coded as '1' if the event occurs and '0' if censored.

Independent variables

Sociodemographics of the child

The child's age, sex, orphan status, disclosure status.

Caregiver-related characteristics

Marital status, educational status, employment status, family size, religion, caregiver's relationship with the child.

Baseline clinical characteristics

History of opportunistic infection (OI), drug regimen, CD4 count, prophylaxis, functional status, WHO clinical stage, haemoglobin level, adherence status, weight for age, height for age, TB screening result, viral load, distance from the health facility.

Definition of terms

Time to LTFU

The time interval between the date of ART initiation to the date of occurrence of event (LTFU) during the study period which will be calculated by subtracting the date of ART initiation (t_o) from the date of occurrence of event (t_e).

Incidence rate of LTFU

The incidence rate of LTFU will be calculated as the number of LTFU children divided by the total person-years of follow-up.

Total person-years of follow-up

The sum of all individual follow-up times.

Transfer out

These are those patients who transferred to another health facility.

Censored

Those children on ART who transferred out to other treatment facilities, died, aged out or were active during the study period.

Table 1 Sociodemographic characteristics of children on ART at health facilities from 1 January 2015 to 30 December 2020, Shashemene town, Oromia region, Ethiopia (n=269)

Variables	N (%)	LTFU (%)	Censored (%)
Age of the child, years			
<2	69 (25.7)	7 (10.14)	62 (89.86)
2–5	123 (45.7)	20 (16.26)	103 (83.74)
6–10	71 (26.4)	15 (21.13)	56 (78.87)
11–14	6 (2.2)	1 (16.67)	5 (83.33)
Sex of the child			
Male	146 (54.3)	29 (10.8)	117 (43.5)
Female	123 (45.7)	14 (11.38)	109 (88.62)
Orphan status			
Non-orphan	149 (55.4)	6 (4.03)	143 (95.97)
Orphan	120 (44.6)	37 (30.83)	83 (69.17)
Disclosure status			
Disclosed	100 (37.2)	9 (9)	91(91)
Not disclosed	169 (62.8)	34 (20.12)	135 (79.88)
Caregiver marital status			
Single	6 (2.2)	1 (16.67)	5 (83.33)
Married	196 (72.9)	32 (16.33)	164 (83.67)
Divorced	33 (12.3)	6 (18.18)	27 (81.82)
Widowed	34 (12.6)	4 (11.76)	30 (88.24)
Educational status of the caregiver			
No education	60 (22.3)	10 (16.67)	50 (83.33)
Primary education	88 (32.7)	15 (17.05)	73 (82.95)
Secondary education	91 (33.8)	17 (18.68)	74 (81.32)
Tertiary education	30 (11.2)	1 (3.33)	29 (96.67)
Employment status of the caregiver			
Employed	108 (40.1)	12 (11.11)	96 (88.89)
Unemployed	161 (59.9)	31 (19.25)	130 (80.75)
Family size			
<2	28 (10.4)	4 (14.29)	24 (85.71)
2–5	214 (79.6)	38 (17.76)	176 (82.24)
>5	27(10)	1 (3.70)	26 (96.30)
Distance from health facility			
Less than 30 min	98 (36.4)	4 (4.08)	94 (95.92)
More than/equal to 30 min	171 (63.6)	39 (22.81)	132 (77.19)
Caregiver religion			
Muslim	114 (42.4)	16 (14.04)	98 (85.96)
Orthodox	70(26)	16 (22.86)	54 (77.14)
Protestant	59 (21.9)	6 (10.17)	53 (89.83)
Catholic	26 (9.7)	5 (19.23)	21 (80.77)

ART, antiretroviral therapy; LTFU, loss to follow-up.

Age out

Age above 15 years and start of adult ART dose CD4 count was categorised as per WHO age-appropriate classification to describe their immunological level. Children under age 1 year and having CD4 cell count <1500 cells/mm^3; children aged 1 year to below 3 years old and having CD4 cell count <750 cells/mm^3; children aged 3 years to below 5 years and having CD4 cell count <350 cells/mm^3; and children aged 5 years to below 15 years and having CD4 cell count <200 cells/mm^3 will be categorised as having CD4 cell count below threshold.[22]

Haemoglobin level

The haemoglobin level was retrieved from records to assess anaemia; for age 6–59 months, <11 g/dL; 5–12 years, <11.5 g/dL; and 12–15 years, <12 g/dL were categorised as anaemic, otherwise not anaemic.[23] Therefore, taking Hgb 10 g/dL to define anaemia in dichotomised analysis as anaemia of <10 g/dL represents anaemia among all age groups of children.

Adherence to HAART was measured by the last adherence level recorded on the follow-up form and classified as good >95%, fair 85%–94%, poor <85% based on the percentage of drug dosage calculated from the total monthly doses of HAART drugs.

Incomplete records

Children who had incomplete data or missing potential variables (date of enrolment, age, adherence status, baseline data (WHO stage, CD4 count, TB screening status, Hgb levels, functional status, weight, height), unknown outcome, transfer in without baseline data.

Data collection tool and procedure

A structured data extraction checklist was used to capture variables relevant to the study. The tool was adapted from the standard HIV/AIDS care intake and follow-up forms and other relevant literature.[24–26] The most recent clinical and laboratory tests performed when starting ART were considered baseline. In cases where the pretreatment laboratory test results were not recorded when ART was started, results of laboratory tests performed within the first 3 months of ART were considered baseline. Four ART clerks who were working at the ART clinic were recruited to collect the data.

Data quality management

Data collectors were given training on the objective of the study and data collection tool. The supervisor and principal investigator closely monitor data completeness and consistency of the entire data collection process. Before data collection, the consistency between the data extraction checklist and the recording system was checked by taking some randomly selected charts; based on this necessary amendments were made. The data were thoroughly coded and then entered into EpiData V.3.1 and exported to Statical package for the Social Sciences (SPSS) V.25 and cleaned before analysis. Nutritional status of children were measured by using Z-score (WAZ, weigth for Age; HAZ, heigth for Age) were generated using WHO AnthroPlus V.1.0.4 software.

Statistical analysis

Descriptive statistics such as frequency and percentages were calculated for categorical variables and survival analysis was carried out to calculate the incidence of LTFU. The Kaplan-Meier method was used to estimate time to LTFU with the log-rank test to test the statistically significant difference observed across the levels of categorical variables. The Cox proportional hazards regression model was used to determine predictors of LTFU from ART. The assumptions of the Cox proportional hazards model were assessed using the Schoenfeld residuals test and log-log plot. Variables (at $p_1 \leq 0.25$) during bivariate analysis were identified and selected for multivariable regression. In the final model variables with a value of $p<0.05$ were considered as statistically significant predictors of LTFU. The strength of the association was measured using adjusted HR (AHR) with its 95% CI.

RESULTS

Sociodemographic characteristics

A total of 298 medical cards belonging to children living with HIV/AIDS who started taking ART drugs were reviewed. Among these, 29 children (9.7%) were excluded due to incomplete data or missing potential variables. Consequently, the analysis included a final sample of 269 children (online supplemental figure 1).

Of the 269 children included in the analysis, 146 (54.3%) were male. The majority of these children, 123 (45.7%), were between the ages of 2 years and 5 years at the initiation of ART. The mean age of the children at the initiation of ART was 4.7 years, with an SD of±2.9. Additionally, more than half of the parents (55.4%) were alive. Furthermore, 169 (62.8%) of the children had not been informed about their HIV status (table 1).

Baseline clinical status of the study subjects

More than two-thirds (66.9%) of the children had a history of OI. Among these, 59 (21.9%) had pulmonary tuberculosis and 29 (10.8%) had recurrent pneumonia. One hundred and forty-seven (54.6%) of the children had received both cotrimoxazole and isoniazid prophylaxis at initiation. Furthermore, approximately 57.2% of the study participants were classified as having mild disease stages (WHO stage 1 and stage 2).

More than half (59.5%) of the children had CD4 counts above the threshold, while only 17.5% of the study children were anaemic (Hgb<10 mg/dL). Moreover, approximately 106 (39.4%) of the children had a suppressed viral load (<1000 copies/ml), and 89.2% of the children exhibited good ART drug adherence in their last 3 months of ART follow-up. Furthermore, approximately 27.1% and 40.1% of the children were underweight and stunted, respectively (table 2).

Table 2 Baseline clinical status of children on ART at health facilities from 1 January 2015 to 30 December 2020, Shashemene town, Oromia region, Ethiopia (n=269)

Variables	N (%)	LTFU (%)	Censored (%)
Past history of OIs			
Yes	180 (66.9)	39 (21.67)	141 (78.33)
No	89 (33.1)	4 (4.49)	85 (95.5)
ART drug			
First line	229 (85.1)	38 (16.59)	191 (83.40)
Second line	40 (14.9)	5 (12.5)	35 (87.5)
Baseline CD4			
Mild/normal	160 (59.5)	10 (6.25)	150 (93.75)
Below threshold	104 (38.7)	31 (29.81)	73 (70.19)
Missing data	5 (1.9)	–	–
Types of prophylaxis			
CPT and INH	147 (54.6)	14 (9.52)	133 (90.48)
CPT	66 (24.5)	7 (10.61)	59 (89.39)
INH	27(10)	–	27(100)
Missing data	29 (10.8)	–	–
Baseline function status			
Appropriate	223 (82.9)	32 (14.35)	191 (85.65)
Delay	31 (11.5)	9 (29.03)	22 (70.97)
Regression	15 (5.6)	2 (13.33)	13 (86.67)
Baseline WHO clinical stage			
Stages 1 and 2	154 (57.2)	15 (9.74)	139 (90.26)
Stages 3 and 4	115 (42.8)	28 (24.35)	87 (75.65)
Baseline haemoglobin level			
≤10 mg/dL	47 (17.5)	10 (21.28)	37 (78.72)
>10 mg/dL	222 (82.5)	33 (14.86)	189 (85.14)
Adherence status			
Good	240 (89.2)	40 (16.67)	200 (83.33)
Fair/poor	29 (10.8)	3 (10.34)	26 (89.66)
Weight for age			
>–2 SD	152 (56.5)	23 (15.13)	129 (84.87)
–2 SD to –3 SD	38 (14.1)	8 (21.05)	30 (78.95)
<–3 SD	73 (27.1)	11 (15.07)	62 (84.93)
Missing data	6 (2.3)	–	–
Height for age			
>–2 SD	117 (43.5)	15 (12.82)	102 (87.18)
–2 SD to –3 SD	44 (16.4)	4 (9.09)	40 (90.09)
<–3 SD	108 (40.1)	24 (22.22)	84 (77.78)

ART, antiretroviral therapy; LTFU, loss to follow-up; OI, opportunistic infection.

Survival status and incidence of LTFU

The LTFU rate was 3.3 per 100 child-years, with a 95% CI of 2.4 to 4.4. The cumulative probability of LTFU among children after the first, second, third, fourth and fifth years was 4.4%, 7.9%, 11%, 14.5% and 17.2%, respectively (figure 1).

The total follow-up time for the entire cohort was 15 589 person-months of observations. The minimum

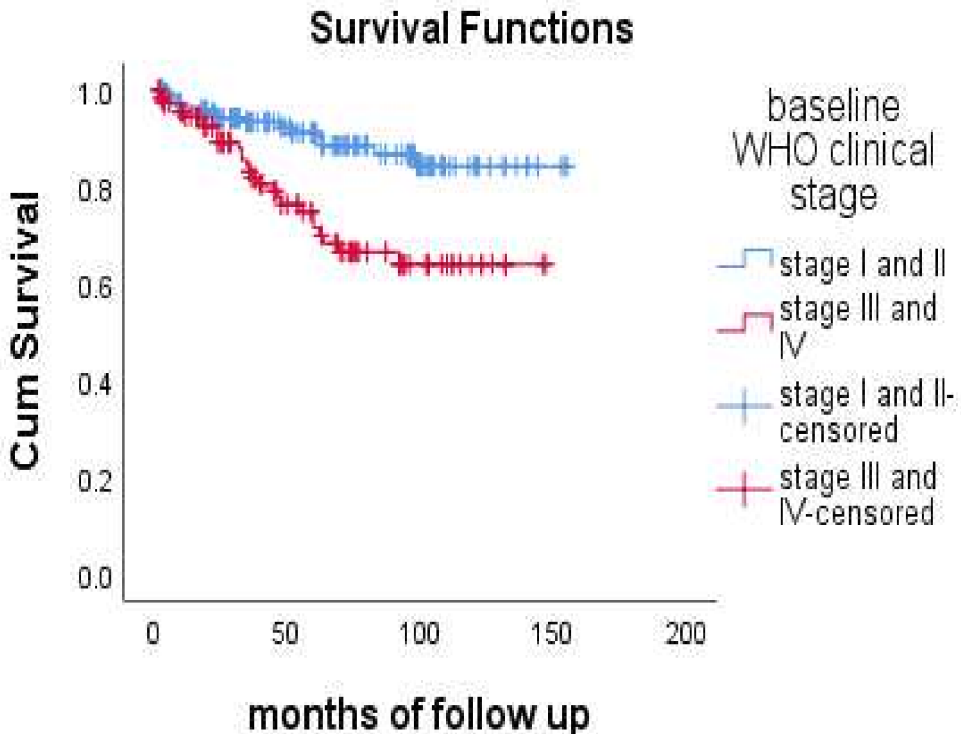

Figure 1 The cumulative probability of loss to follow-up (LTFU) among children on ART in health facilities, Shashemene town. As the children receive ART for a longer period of time the probability of LTFU increases. ART, antiretroviral therapy.

and maximum follow-up periods were 2 months and 155 months, respectively. The median follow-up time was 52 months, with an IQR of 24–92 months. Additionally, the median survival time to LTFU was 33 months, with an IQR of 12–56 months.

Comparison of survival functions

Those children in WHO clinical stages 3 and 4 were LTFU significantly than those in clinical stages 1 and 2 (online supplemental figure 2). Orphaned children were more likely LTFU than their counterparts (online supplemental figure 3).

Factors associated with LTFU

In the bivariate analysis, several variables, including year of enrolment, age of children, orphan status, caregiver relation with child, caregiver education, caregiver occupation, distance from facility, height for age, disclosure status, having anaemia during ART initiation, past history of OI, baseline WHO clinical stage, baseline CD4 count below threshold level, viral load and children's TB screening at baseline, demonstrated a value of $p<0.25$. Consequently, these variables were selected for inclusion in the multivariable Cox regression analysis.

In the multivariable Cox regression model, factors such as being less than 5 years of age, year of enrolment to care, non-orphan status of the child, distance from the health facility, disclosure status, history of OI, and CD4 count below threshold level were identified as significant predictors of LTFU, with a value of $p<0.05$ (table 3).

According to the findings, children aged less than 5 years at enrolment were 97% less likely to be lost to follow-up compared with children of older ages (AHR 0.03, 95% CI 0.00 to 0.36). Children with baseline CD4 counts below the threshold were 5.17 times more likely to be lost to follow-up than children with normal immunological status (AHR 5.17, 95% CI 2.08 to 12.85). Non-orphan children had an 87% lower risk of LTFU compared with orphan children (AHR 0.13, 95% CI 0.05 to 0.34).

Children enrolled in care in earlier years were less likely to be lost to follow-up compared with recent enrolment in care (AHR 0.14, 95% CI 0.04 to 0.51). Similarly, children who were informed about their HIV status were 62% less likely to be lost to follow-up compared with their counterparts who were not informed (AHR 0.32, 95% CI 0.13 to 0.80).

DISCUSSION

The study evaluated the rate of LTFU and its factors among children living with HIV who were enrolled in ART programmes at public health facilities in Shashemene town. The incidence rate of LTFU among HIV-positive children was determined to be 3.3 per 100 child-years, based on a total of 15 589 person-months of follow-up.

This finding is consistent with previous studies conducted in Ethiopia, which reported an LTFU rate of 4.5 per 100 child-years of observation,[12] South Africa 5 per 100 child-years of observation,[27] Asia and Africa 4.1 per 100 child-years of observation.[10] The observed difference in the incidence of LTFU between studies conducted in South Africa, Asia and Africa, and the study conducted in Shashemene town, Ethiopia, could potentially be

Table 3 The overall predictors of loss to follow-up among children on ART at health facilities of Shashemene town, Oromia, Ethiopia (n=269)

Variables	CHR (95% CI)	AHR (95% CI)	P value
Age of child at enrolment, years			
<2	0.16 (0.02 to 1.34)	0.03 (0.00 to 0.34)	0.005 **
2–5	0.27 (0.04 to 2.10)	0.03 (0.00 to 0.36)	0.005**
6–10	0.53 (0.07 to 4.10)	0.11 (0.01 to 1.13)	0.06
11–14	Ref	Ref	
Year of enrolment to care			
<2007	0.26 (0.10 to 0.70)	0.14 (0.04 to 0.51)	0.003 **
2007–2009	0.45 (0.16 to 1.35)	0.24 (0.06 to 1.00)	0.049 *
2010–2012	Ref	Ref	
Caregiver relationship with child			
Biological parent	0.50 (0.24 to 1.01)	1.2 (0.45 to 3.17)	0.71
Non-biological	Ref	Ref	
Caregiver educational status			
No education	7.21 (0.92 to 56.37)	4.55 (0.54 to 38.31)	0.16
Primary education	6.20 (0.82 to 46.95)	11.2 (0.36 to 92.5)	
Secondary education	6.97 (0.93 to 52.43)	7.59 (0.93 to 61.82)	0.06
Tertiary education	Ref	Ref	
Caregiver employment status			
Employed	0.52 (0.27 to 1.02)	1.11 (0.36 to 3.41)	0.85
Unemployed	Ref	Ref	
Orphan status of a child			
Non-orphan	0.13 (0.05 to 0.30)	0.13 (0.05 to 0.34)	<0.001**
Orphan	Ref	Ref	
Distance from health facility			
Less than 30 min	0.15 (0.05 to 0.42)	0.24 (0.08 to 0.73)	0.012*
Greater than/equal to 30 min	Ref	Ref	
Disclosure status			
Disclosed	0.37 (0.18 to 0.76)	0.32 (0.13 to 0.80)	0.014*
Not disclosed	Ref	Ref	
Past history of opportunistic infections			
Yes	4.87 (1.74 to 13.64)	3.54 (1.15 to 10.87)	0.027*
No	Ref	Ref	
Immunologic status (CD4 count)			
Below threshold	4.69 (2.30 to 9.57)	5.17 (2.08 to 12.85)	<0.001**
Mild/normal	Ref	Ref	
Baseline haemoglobin level			
≤10 mg/dL	1.53 (0.751 to 3.095)	0.81 (0.34 to 1.94)	0.63
>10 mg/dL	Ref	Ref	
Baseline WHO clinical stage			
Stages 1 and 2	0.36 (0.19 to 0.68)	0.68 (0.32 to 1.47)	0.328
Stages 3 and 4	Ref	Ref	
Baseline TB screening			
Positive	1.64 (0.892 to 3.032)	1.2 (0.46 to 3.11)	0.71
Negative	Ref	ref	

Continued

Table 3 Continued

Variables	CHR (95% CI)	AHR (95% CI)	P value
Baseline viral load			
≤1000 (low)	0.26 (0.114 to 0.586)	0.78 (0.26 to 2.30)	0.65
>1000 (high)	Ref	Ref	
Height for age			
>−2 SD	0.54 (0.29 to 1.04)	1.53 (0.62 to 3.80)	0.357
−2 SD to −3 SD	0.41 (0.14 to 1.19)	0.60 (0.13 to 2.78)	0.515
<−3 SD	Ref	Ref	

**p-value<0.05 and strongly associated,*p-value<0.05 and associated
AHR, adjusted HR; ART, antiretroviral therapy.

attributed to variations in the definition of LTFU. In the South African, Asian and other African studies, LTFU was defined as interruption of ART for more than 6 months. However, in the study conducted in Shashemene town, Ethiopia, LTFU was defined as not receiving ART refills for more than 90 days.

The finding of this study was lower than study done in Ethiopia 6.2 per 100-child years of observation,[18] India 14.4,[28] South Africa 10.8 per 100 Child year of observation,[29] Malawi 12.96.[30] The lowest incidence density in our case could be due to the differences in sample sizes, study periods and settings. Conversely, the finding of this study was high as compared with the study done in six countries in Asia; 0.54 per 100 child-years of observation.[31] The difference for the Asian study with this study might be the definition of the outcome variable (LTFU; lost from care for >12 months).

According to the multivariable Cox proportional hazards model, children aged less than 5 years at enrolment were less likely to follow-up as compared with children of older ages (AHR 0.03, 95% CI 0.00 to 0.36). This finding was in line with the studies in Ethiopia,[17] Indonesia,[32] Asia[31] and Spain;[33] older children were more lost to follow-up compared with their younger counterparts. However, this finding is in contrast with the studies in Adama and South Africa; children of older ages were less likely LTFU: Adama, AHR 12[13] and South Africa, AHR 0.61.[27] This might be due to the difference in the sociodemographic characteristics of the study participants.

Children cared for by biological parents (non-orphaned) faced less risk of LTFU compared with orphans (AHR 0.13, 95% CI 0.05 to 0.34). This finding was contradicted by a study done in North-West Ethiopia; children cared for by their biological parents (non-orphans) were more likely to be lost to follow-up compared with their counterparts (AHR 2.58).[18] These contradictory findings suggest that the risk of LTFU among children may vary depending on the context, cultural factors, and other variables specific to the study population and location.

The death of mothers during the follow-up period could certainly contribute to the increased risk of LTFU among children. In addition, the fear of stigma and discrimination by caregivers can act as a barrier to accessing and remaining in care. These factors highlight the complex interplay between sociocultural, economic and healthcare system factors that influence health outcomes, particularly for vulnerable populations such as orphans and children affected by HIV. The efforts of programmes like the OVC Programme in Africa, in collaboration with healthcare workers, are crucial for locating and re-engaging vulnerable individuals who have been lost to HIV care. Continued investment in such programmes, along with targeted interventions to address the underlying social determinants of health, can help improve retention in HIV care.[15]

The result indicated loss to the follow-up were associated with recent year enrolment, (<2007 year) of ART initiation were less likely LTFU compared with counterparts; (AHR 0.14, 95% CI 0.04 to 0.51). This finding was similar to the study done in Ethiopia, children enrolled to care in more recent years more likely LTFU; (AHR 1.9),[34] six West African countries,[35] south Africa,[27] Asia and Africa multi regional analysis[10] and Indonesia.[32]

Children aware about their HIV status were less likely to be lost to follow-up as compared with their counterparts who were not aware (AHR 0.32, 95% CI 0.13 to 0.80). This finding is in line with the WHO recommendation of age-appropriate disclosure status and caregiver regular support in order to reduce LTFU of children from ART services.[4]

Children lost to follow-up were associated with low immunological status (CD4 count below the threshold) and history of OIs at ART baseline. Children with a history of OIs were 3.5 times more likely to be lost to follow-up compared with their counterparts (AHR 3.54, 95% CI 1.15 to 10.87). This might be due to preconditions of lowered immune status. Children with a CD4 count below the threshold were more likely to be lost to follow-up as compared with children with a normal CD4 count (AHR 5.17, 95% CI 2.08 to 12.85). This finding was in line with a study in southern Ethiopia, baseline CD4 <200mm^3/dL (below threshold levels) 1.7 times more likely to be LTFU than normal; (AHR 1.7)[17] and study done in Adama, low CD4 cell counts were 1.85 times more likely LTFU as

compared with its counterparts; (AHR 1.85, 95% CI 1.15 to 2.98).[13]

In Ethiopia, one of the risk factors increasing LTFU among HIV-infected children was the distance from the health facility and lack of transportation.[4 15] Our study also showed that short distance from the health institution (less than 30 min) decreased the likelihood of LTFU as compared with more than 30 min walking distance (AHR 0.15, 95% CI 0.05 to 0.42). This result is similar to that of a study in India; those who got the service within 30 min were less likely to be lost to follow-up when compared with those who got the service at a distance more than 30 min away.[20] Not all healthcare facilities give ART service and there is difficulty in accessing favourable transportation, as a result of which they could miss their appointments. Additionally, caregivers maybe forget to take their children to the ART clinic.

Though this study reports relevant findings, uses censored observations for analysis and has a 5-year follow-up period for estimating the cumulative rate of LTFU, it has some limitations. Excluding incomplete data could have underestimated or overestimated the outcome. Data are limited on important possible predictors of LTFU, including viral load, vaccination status and child nutritional factors. The range of variables and number of children that could be included in multivariable models may be limited by the missing data. This study used secondary data and was unable to determine the cause and outcome of LTFU.

Conclusion and recommendation

The incidence rate of LTFU in this study was notably lower compared with other studies. The findings also highlighted that children over 5 years of age, orphaned children, children with low immune status, those with a history of OIs at baseline, those who had not disclosed their HIV status, and those living far from the health facilities were at a higher risk of LTFU.

Therefore, special emphasis and close monitoring are essential for orphaned children. Additionally, tracing mechanisms should be reinforced for children living far from service sites. Furthermore, it is recommended to involve the patients in decision-making regarding the initiation of ART after HIV confirmation, rather than enforcing immediate treatment.

The Ministry of Health should prioritise initiatives aimed at improving access to ART services for clients and implementing age-appropriate disclosure options for paediatric antiretroviral treatment programmes nationwide. Healthcare providers must focus on early diagnosis and prompt enrolment into ART programmes, while also facilitating the disclosure of HIV status and providing support to vulnerable children to ensure their continued engagement in care.

Health workers should place particular emphasis on addressing the low immune status of patients during clinical care. Additionally, conducting further prospective follow-up studies that consider factors such as viral load, child immunisation, and nutritional deficiencies is highly recommended to enhance patient outcomes and treatment efficacy.

Lastly, qualitative studies should be conducted to explore the underlying reasons for LTFU among patients. These studies can provide valuable insights into the barriers and challenges faced by patients, thereby informing the development of targeted interventions to improve retention in HIV treatment programmes.

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