

# Measuring retention in care for HIV-positive pregnant women in Prevention of Mother-to-Child Transmission of HIV (PMTCT) option B+ programmes: the Mozambique experience

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## Research article

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## Abstract

Background Failure of retention of HIV-positive pregnant women on ART leads to increased mortality for the mother and her child. This study evaluated different retention measures intended to measure women's engagement along the continuum of care for prevention of mother-to-child transmission (PMTCT) option B+ services in Mozambique. Methods We compared 'point' retention (patient's presence in care at 12-months post-antiretroviral treatment (ART) initiation or any time thereafter) to the following definitions: alive and in care at 12 months post-ART initiation (Ministry of Health); attendance at a health facility up to 15 months post-ART initiation (World Health Organisation); alive and in treatment at 1, 2, 3, 6, 9, and 12 months post-ART initiation (Inter-Agency Task Team); and alive and in care at 12 months post-ART initiation with  $\geq 75\%$  appointment or on-time adherence during follow-up ('appointment adherence' and 'on-time adherence' retentions). Kaplan-Meier survival curves were produced to assess variability in retention rates. We used 'on-time adherence' retention as a gold standard to estimate sensitivity, specificity, and proportion of misclassified patients. Results Considering the 'point' retention definition, 16,840 HIV-positive pregnant women enrolled in option B+ PMTCT services were identified as 'retained in care' 12 months post-ART initiation. Of these, 60.3% (95% CI 59.6–61.1), 84.8% (95% CI 84.2–85.3), and 16.4% (95% CI 15.8–17.0) were classified as 'retained in care' using MOH, WHO, and IATT definitions, respectively, and 1.2% (95% CI 1.0–1.4) were classified as 'retained in care' using the ' $\geq 75\%$  on-time adherence' definition. All definitions provided specificity rates of  $\geq 98\%$ . The sensitivity rates were 3.0% with 78% of patients misclassified according to the WHO definition and 4.3% with 54% of patients misclassified according to the MOH definition. The 'point' retention definition misclassified 97.6% of patients. Using IATT and 'appointment adherence' retention definitions, sensitivity rates (9.0% and 11.7%, respectively) were also low; however, the proportion of misclassified patients was smaller (15.9% and 18.3%, respectively). Conclusion More stringent definitions indicated lower retention rates for PMTCT programmes. Policy makers and programme managers should include attendance at follow-up visits when measuring retention in care to better guide planning, scaling up, and monitoring of interventions.

## Background

Retention in prevention of mother-to-child transmission of HIV (PMTCT) care has both individual and public health consequences. At the mother-infant pair level, being in care contributes to higher maternal antiretroviral therapy (ART) adherence, better viral suppression, and ensures better post-natal care, including full ART prophylaxis and complete infant testing to HIV-exposed infants (HEI) (1,2). In contrast, failure to be retained in care can lead to delayed or inconsistent use of antiretroviral medications, higher rates of maternal viral load failure, and increased morbidity and mortality for the mother and her child (3–5). In addition, recent publications have reported an upward trend in acquired drug resistance to first-line ART across low- and middle-income countries, principally due to sub-optimal viral suppression (6–8). Therefore, non-achievement of viral suppression can lead to a higher risk of HIV transmission and secondary infections with acquired drug resistance strains and is, therefore, considered a public health threat (9).

When referring to retention in care, publications often consider 'point' retention, which is defined in relation to a patient's presence in care at a certain time point. For women and children enrolled in PMTCT services, attendance at a clinic at a certain time point is often considered to be full retention over this time period. While such a simple definition is useful, it has been demonstrated for HIV-infected adults that between one- and two-thirds of patients are not in regular care (10). Therefore, regularity of attendance is an important parameter to consider if quality engagement in care is to be evaluated (11).

To address shortcomings in this simple definition, attempts to better measure retention in care in PMTCT services have been made (12,13). In 2014, a World Health Organisation (WHO) monitoring and evaluation working group published consolidated strategic information guidelines and proposed that retention in care of HIV-infected pregnant and breastfeeding women was equivalent to attendance at a health facility at 12-months post-initiation of ART, or at any time up to 3 months later (12). The 12-month time point was agreed to align with the adult ART monitoring guidelines; however, it fails to address the ongoing risk period associated with continued breastfeeding beyond 12 months. In 2015, the Inter-Agency Task Team (IATT) on Children and HIV and AIDS defined maternal retention as 'the proportion of HIV-positive pregnant and/or breastfeeding women on ART alive and in treatment at 1, 2, and 3 months post-ART initiation (early retention), and then at 6, 9, and 12 months post-ART initiation', where retention was considered as a continuous engagement (13). Despite such efforts, there is no consensus on what constitutes 'retention in care', with no gold standard determined. In 2010, Mugavero et al. provided a synopsis of five commonly used definitions of retention in HIV care and treatment services, ranging from a simple count of the number of missed visits to a more complex medical visit performance measure that incorporated elements of appointment consistency and gaps in care (10). While that study provided important insights on methodological and conceptual strengths and limitations of each definition, no comparative analysis of these definitions has been undertaken.

In this study, we aimed to evaluate different measures of retention that could reflect more accurately the nature of women's engagement along the PMTCT care continuum. We hypothesised that 'point' retention might overestimate the level of engagement in care of women enrolled in PMTCT programmes, and that programme outcomes in a high HIV-burden country such as Mozambique would be better evaluated when the level of attendance of scheduled visits during follow-up was taken into account. More specifically, the objectives of this analysis were to: i) assess the variability of different measures of retention at 12 months post-ART initiation under PMTCT option B+ programmes using different definitions of retention in care; ii) compare the sensitivity and specificity of the different definitions in detecting women fully engaged in care at 12 months post-ART initiation; and iii) discuss the programmatic implications of each definition in the context of PMTCT option B+ programmes.

## Methods

### Setting

Data for the present analyses were extracted from electronic patient-level databases (ePLD) from 86 Ministry of Health (MOH) facilities providing PMTCT option B+ and HIV care and treatment services in Nampula and Zambézia provinces in Mozambique. The programmes were supported by ICAP at Columbia University through funding from the United States President's Emergency Plan for AIDS Relief (PEPFAR).

Officially adopted in 2013, the option B+ strategy in Mozambique uses a 'one-stop-model' and 'Test and Treat' approach where pregnant and breastfeeding women are counselled and tested in mother and child health (MCH) services and, if found HIV-positive, are started on lifelong ART that same day. HIV care and treatment are integrated within MCH services and ART provision is administered by nurses. For HIV-positive pregnant women, a second consultation occurs within the first week post-ART initiation, and a monthly clinical follow-up is conducted during the first 6 months of ART, followed by bi-monthly follow-ups during breastfeeding until 12 months of treatment and bi-annually thereafter until the end of breastfeeding. ART counselling and drug pickup are conducted on a monthly basis for the first year of treatment. Routine viral load (VL) monitoring is recommended at 3 and 12 months post-ART initiation and annually thereafter. HIV-positive women are followed in MCH services until the final HIV status of the exposed infant is determined (14). More detailed descriptions of the PMTCT programme settings and data sources are described elsewhere (*manuscript, L Ahoua, 2019*).

The Mozambique provinces targeted for the study officially implemented option B+ in July 2013. Of all HIV-positive women who were enrolled in PMTCT option B+ programmes and who were started on ART between July 1<sup>st</sup>, 2013 and December 31<sup>st</sup>, 2017, we selected those who were considered as 'retained in care' at 12 months post-ART initiation according to the 'point' retention definition (i.e. patient alive and present in care at 12 months post-ART initiation, or any time thereafter) and with a follow-up time of at least 12 months under ART to allow complete assessment of engagement in care during the first year of treatment. These selected women constituted the basis of comparison for the subsequent analyses assessing variability in different definitions concerning retention measures.

## Comparing definitions

The 'point' retention definition was compared against the following five definitions: MOH (15), WHO (12), IATT (13), 'appointment adherence' retention (10), and 'on-time adherence' retention (16) (Table 1). Similar to the 'point' retention definitions, the MOH and WHO retention definitions assess retention at a single time point. For women's attendance at a clinic, we considered different types of visits including medical consultations, pharmacy drug refills, counselling, or laboratory analysis. This approach allowed us to consider HIV care as a holistic strategy, given that HIV care is provided in an increasingly team-based environment with non-prescribing healthcare professionals taking on expanded roles in direct patient care. Table 1 summarises the definitions of retention according to different measures and shows how failure events were accounted for in statistical analyses.

## Statistical analysis

Women's appointment adherence, as well as their on-time adherence to scheduled visits, were expressed as percentages, median, and interquartile range [IQR]. Women's retention status was classified into a binary outcome (retained vs. not retained in care) using a 75% threshold for clinical attendance. Each woman contributed to the analyses from the date of ART initiation to the first occurrence of a failure event, as described in Table 1. To allow sufficient time to analyse clinical attendance within the first year of treatment, we only included women who initiated ART up until December 31<sup>st</sup>, 2016 and for whom the theoretical follow-up time under ART was  $\geq 12$  months.

Kaplan-Meier survival curves were produced to estimate retention in care at 3, 6, 9, and 12 months post-ART initiation using each of the definitions described above. We assessed variability in the different measures of retention between respective definitions used. We did not consider 'appointment adherence' retention for the survival analysis, as this definition does not contemplate a time event, but rather a total number of visits completed during the observation period.

We assessed sensitivity, specificity, and the proportion of misclassified women for each alternative definition of retention compared to the reference of an 'ideal case scenario' of full 'on-time adherence' retention, defined as a woman alive and in care 12 months post-ART initiation and 375% of scheduled visits attended on time (+/- 15 days). Sensitivity and specificity values were calculated with 95% confidence intervals.

## Results

A total of 31,186 HIV-positive women were enrolled in the PMTCT option B+ programme initiating ART during the study period. Of these, 18,739 were considered as being retained in care at 12 months post-ART initiation according to the 'point' retention definition. We excluded 1,899 women with a follow-up ART time of <12 months. Finally, 16,840 women were included in this study.

Of 16,840 women included, only 2,764 (16%) and 407 (2%) were considered retained at 12 months post-ART initiation when considering regularity and timeliness of appointment attendance, respectively (Figure 1). The occurrence of irregular (IATT's definition) and delayed ('on-time' definition) clinical attendance was documented as early as 2–3 months post-ART initiation. The median frequency of appointment adherence to scheduled visits for all women included was 66.7% (IQR 57.1%–80.0%) and the median frequency of on-time adherence was 40.0% (IQR 22.2% – 52.9%).

Figure 2 shows Kaplan-Meier survival curves for retention over time up to 12-months post-ART initiation using the different definitions. Among the 16,840 B+ pregnant women considered retained in care according to the 'point' retention definition, 84.8% (95% CI 84.2–85.3) were actually defined as retained in care when estimated using the WHO definition (i.e. attendance at a health facility up to 15 months post-

ART initiation), 60.3% (95% CI 59.6–61.1) with the MOH definition (i.e. alive and in care at 12 months post-ART initiation), and 16.4% (95% CI 15.8–17.0) with the IATT definition (i.e. alive and on treatment at 1, 2, 3, 6, 9, and 12 months post-ART initiation), respectively. When using the ‘on-time adherence’ retention definition (i.e. alive and in care at 12 months post-ART initiation with at least 75% of on-time adherence during follow-up), only 1.2% (95% CI 1.0–1.4) were defined as retained in care.

We considered the gold standard category to be the 407 women alive and in care 12-months post-ART initiation with at least 75% on-time adherence. We calculated the sensitivity and specificity of other definitions to more accurately classify the women into a more suitable category of retention and determine the proportion of misclassified patients. While all definitions provided specificity rates of  $\geq 98\%$ , the sensitivity to detect a patient actually retained in care with  $\geq 75\%$  of on-time adherence was  $<12\%$  (Table 2). The WHO and MOH retention definitions provided the lowest sensitivity figures and the highest proportion of women misclassified as retained in care as follows: 3.0% sensitivity (95% CI 2.7%–3.3%) with 78% of patients misclassified according to the WHO definition and 4.3% sensitivity (95% CI 3.9%–4.7%) with 54% of patients misclassified according to the MOH definition. In addition, the ‘point’ retention definition misclassified 97.6% of patients. Although sensitivity rates were also low when using the IATT and ‘appointment adherence’ retention definitions, the proportion of misclassified patients was relatively smaller (15.9% and 18.3%, respectively).

## Discussion

We analysed six different definitions of ‘retention in care’ for HIV-positive pregnant women enrolled in PMTCT option B+ programmes ranging from the most lenient definition using a ‘point’ retention approach to the most stringent definition using an ‘on-time adherence’ retention approach. Of the six definitions, three definitions assess retention at a single time point (‘point’ retention, WHO, and MOH). The IATT, the ‘appointment’ and the ‘on-time adherence’ retentions approaches reflect a more continuous engagement in care, where follow-up visits between initiation of ART and the endpoint date are considered.

As expected, we found that the more stringent the definition, the lower the probability for women to be defined as retained in care; and when levels of attendance to visits during follow-up were considered, estimates were even lower (85% and 60% when using the WHO and MOH definitions compared to 16% and 1% when using the IATT and ‘on-time adherence’ retention definitions). At the end of the first year, most women starting ART had not adhered to their scheduled visits, with median appointment adherence at 66% and median on-time adherence at 40% among the 16,840 women considered as retained in care using the ‘point’ retention definition. Of these, only 16% and 2% were actually defined as retained in care 12 months post-ART initiation, if we considered a threshold of  $\geq 75\%$  for appointment and on-time attendance, respectively.

Initial visits in the first year of ART initiation are critical to ensure successful engagement in care, involving intensive counselling, peer support, conveying important preventive healthcare and risk reduction messages, and monitoring patterns of healthier behaviour for the women and their exposed

children. This interaction between the health system and the HIV-infected women determines the likelihood of survival of the pair and the mother-to-child transmission of HIV. Adding the frequency and regularity of visits into the concept of retention increases the quality of the PMTCT programme evaluations, enabling a distinction to be made between women who attend for all or some care and treatment, and those who completely fail to adhere to scheduled visits and are therefore considered not to be engaged in care.

Table 3 provides a summary of the advantages, limitations, and programmatic implications of the six measures of retention concerning the PMTCT option B+ programmes (10,11). Based on our results, the three-single time point measures, namely, the 'point', WHO, and MOH definitions, were a classical programmatic approach to measure retention in care under ART. While relatively easy to use, they do not capture important milestones in the PMTCT context; for example, at delivery, at 2-months post-partum for early infant diagnosis, or at the end of breastfeeding for the final HIV determination of the HIV-exposed infant. In addition, they do not consider visit consistency, which has been demonstrated to be significantly associated with ART adherence and viral suppression among HIV-positive adults (17,18). However, the three definitions that capture visit consistency along the continuum of care, namely, the IATT, 'appointment' and 'on-time adherence' definitions, were more complex to use as they included multiple clinic visits (repeated measures) occurring longitudinally over time. This could become extremely challenging in limited-resource settings where limited qualified human resources are available to document such information, data collection tools are not adapted to capture longitudinal follow-up, and there are numerous entry points where women are followed within the same health facility or between sites (11,19). To correctly capture patients' follow-up, different data sources need to be combined or triangulated, for example, with counselling registers and with laboratory or pharmacy records. Electronic databases may help this process, but these are generally implemented in high volume and accessible sites and may not necessarily be representative of the entire country for national programmes. However, all three definitions enabled adding the concept of a continuum of care to point retention estimates.

When considering 'on-time adherence' retention as the gold standard, all other definitions provided very low sensitivity rates to accurately detect patients retained in care, with high rates of misclassified patients. The WHO and MOH retention definitions provided the lowest sensitivity rates, that is, 3% and 4%, respectively. For the 'point' retention, WHO, and MOH definitions, which did not consider continuous follow-up in their calculations, the proportion of misclassified patients ranged from 54% to 97%. The 'appointment adherence' definition provided the highest sensitivity rate (11.7%), with a fairly low proportion of misclassified patients (18.3%) compared to all other definitions analysed. We found that the median time to first failure of correct follow-up was short ( $\leq 3$  months), if visit attendance during follow-up was considered, which demonstrated the need to implement early preventive measures to avoid patients on the PMTCT programme disengaging from care. Such strategies should focus on already well-known barriers to regular attendance, such as a lack of disclosure, poor staff attitudes, competing personal priorities, medication side-effects, or transport difficulties (16).

While our definition of 'on-time adherence' retention represents the ideal situation in which an HIV-positive pregnant woman enrolls in a PMTCT programme and starts ART under option B+ should be considered as fully engaged in care to ensure an optimal viral response, it is perhaps too stringent for PMTCT programme evaluations. It is also time consuming to use on a routine basis and may not be compatible with current PMTCT service settings. Therefore, we recommend either using the IATT or the 'appointment adherence' retention definitions to better measure levels of engagement in care for mother-infant pairs.

Our analysis had several limitations. To accurately evaluate attendance at scheduled visits, it is desirable to distinguish visits cancelled in advance (either by the patient or the care provider) from 'no show' visits that are actually visits missed by the patient (10). Our data did not allow this distinction to be made as this information was not captured in the database. Therefore, our results may have underestimated the real values of women's engagement in care when analysing 'appointment' and 'on-time' adherence retentions.

Some women, although defined as having a full attendance at scheduled visits, did not follow *per se* the recommended schedule of visits as per national guidelines. More frequent visits may indicate a more advanced HIV disease, problems in counselling that need to be addressed, or drug or laboratory reagent stock-outs (19). Less frequent clinical visits may reflect a stabilised disease stage or temporary silent transfers (i.e. women receiving ART services elsewhere for a short period of time). For this reason, we chose to use all scheduled visits, regardless of whether the visits fell into expected time intervals. We did not analyse treatment interruptions and gaps in care for similar reasons. Further research is warranted to investigate the effect of a lack of observation of the recommended schedule of visits as per national guidelines on PMTCT programme outcomes.

**Finally, we analysed data from health facilities with ePLD in two provinces in Mozambique.** Although these two provinces are among the most populated in the country, with large volumes of patients seen at health facilities, our results may not be generalisable to other regions in Mozambique or to other resource-limited settings.

## Conclusion

Balancing the need to reflect correct attendance and capture the regularity of visits without involving complex computer processing of the available routine data can be a daunting task. In addition, applying more stringent definitions is likely to result in lower reported rates of retention in care for PMTCT programmes. However, policy makers and programme managers should consider systematically taking into account attendance at follow-up visits to better guide decision-making concerning planning or scaling up interventions for mother-infant pairs. A consensus on a practicable definition is urgently needed, based on data availability, clinic scheduling practices, and local analytical capacities. Without overall agreed guidelines, findings from different programmes and interventions cannot be satisfactorily compared. Finally, a retention indicator is used in modelling estimates for vertical transmission of HIV. Without accurate and correct estimates, it is not possible to evaluate programme achievements

effectively in respect of elimination of mother-to-child transmission of HIV. This consideration may become particularly important as recent programmatic data seem to indicate a stagnation in the achievements of PMTCT programmes worldwide, which suggests the need for revised global, national, and local strategies to end the HIV epidemic by 2030. (20).

## List Of Abbreviations

|        |  |
|--------|--|
| PMTCT  | Prevention of mother-to-child transmission of HIV        |
| ART    | Antiretroviral treatment                                 |
| WHO    | World Health Organisation                                |
| IATT   | Inter-Agency Task Team                                   |
| HEI    | HIV-exposed infants                                      |
| ePLD   | Electronic patient-level database                        |
| PEPFAR | United States President's Emergency Plan for AIDS Relief |
| MCH    | Mother and child health                                  |
| VL     | Viral load   |
| MOH    | Ministry of Health                                       |
| IQR    | Interquartile range                                      |

## Declarations

**Ethics approval and consent to participate:** This study was part of the 'Identifying Optimal Models of HIV Care and Treatment' collaboration which was approved by the Mozambican National Ethics Committee and the Columbia University Medical Center IRB. Additional technical and administrative approval was received from the US Centers for Disease Control and Prevention and the Office of the Global AIDS Coordinator, US Department of State. Informed consent to participate was not required as this study was solely based on secondary data analyses of de-identified routine service delivery data. As part of the 'Optimal Models' Collaboration, the Columbia University IRB Committee did not consider this study to be a human subject research, as there was no interaction with subjects and no intervention, and private, identifiable information was not collected.

**Consent for publication:** All authors have provided consent for the publication of this manuscript.

**Availability of data and material:** No original data were used in the study; only secondary routinely collected de-identified service delivery data were used. The datasets analysed during the current study are currently not publicly available. An anonymised dataset can be available from the corresponding author on reasonable request.

**Competing interests:** The authors declare that they have no competing interests.

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**Authors' contributions:** LA, TT, SA, RB participated in the study design. LA carried out the data collection and LA, TT, SA participated in the data analysis. LA drafted the manuscript, TT, SA and DA participated in the revision of the drafted manuscript and all authors read and approved the final manuscript

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## Tables

Due to technical limitations, tables are only available as a download in the supplemental files section.

## Figures

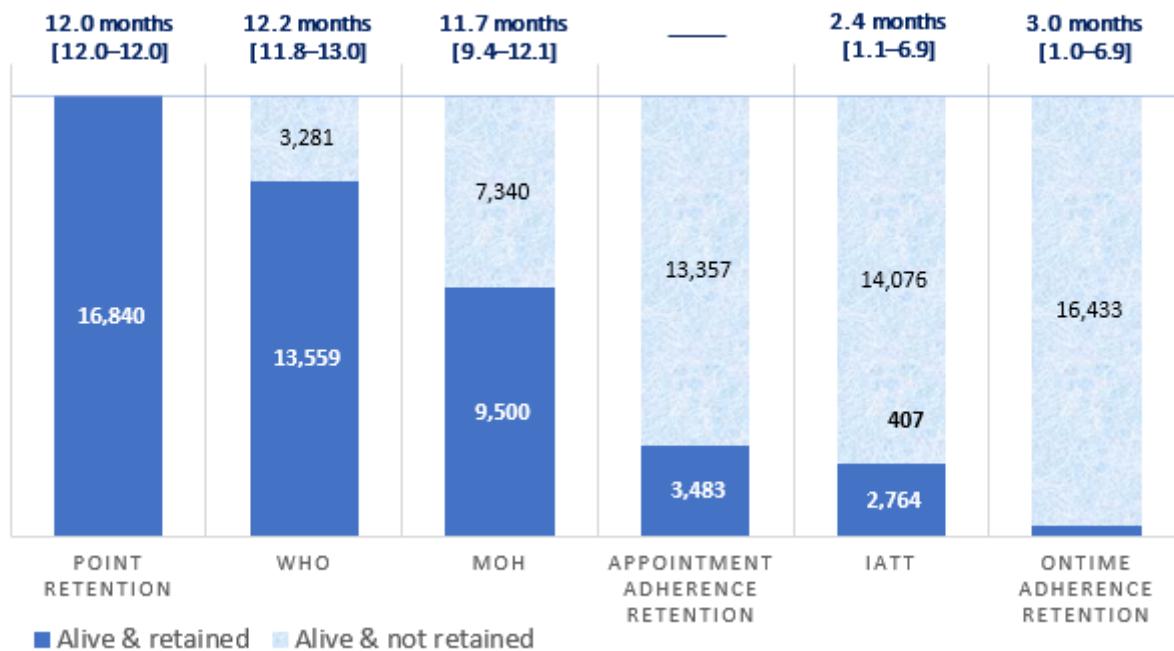
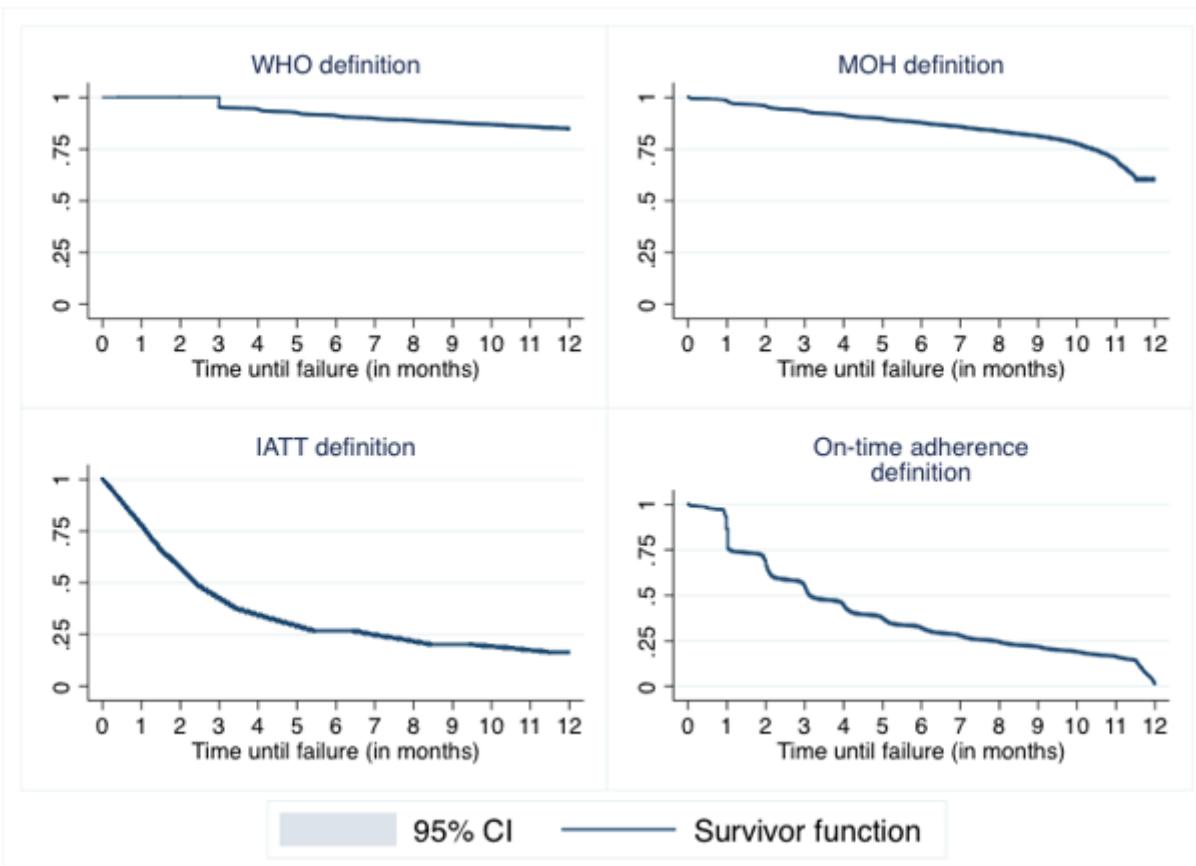


Figure 1

B+ pregnant women retained in care 12 months post-ART initiation: time to first failure event.



**Figure 2**

Estimated Kaplan-Meier survival curves for retention over time, by retention definition.

## Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [supplement1.pdf](#)