# Viral Load Predicts Virologic Failure on Repeat Testing in Children on ART at a Large Clinic in Kisumu, Kenya: A Retrospective Cohort Study

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## Background

An estimated 1.8 million children were living with HIV/AIDS in 2019, a majority of whom live in Africa. A patient with a viral load of <1000 cps/mL is considered virally suppressed. In most analyses, only 60-75% of children in low and middle-income countries had achieved viral suppression. Virologic failure can result in increased risk of infections, disease progression, and mortality. While a viral load of <1000 cps/mL is considered suppressed in resource limited settings, there are a portion of HIV patients with consistent viral loads between 100-1000 cps/mL. Adult studies have shown that adults on ART with low level viremia (LLV) (viral loads >0 but <1000 cps/ml) have higher rates of eventual virologic failure. LLV has not been extensively studied in children.

## Methods

**Setting:** online Kenyan national database; chart abstraction from a large urban clinic in Kisumu, Kenya
**Population:** Children ages 0-14 with at least 2 viral loads, taken 6 months apart, between January 2015 and July 2018.
**Statistical Analysis:** First VL during the study period was compared with subsequent VL(s). Undetectable VL was defined as 0-39 copies/mL, LLV 40-999 copies/mL, and virologic failure ≥ 1000 copies/mL. Chi square test was used to measure the association between first viral load and other risk factors. Multivariate logistic regression was performed controlling for sex and time on ART to evaluate association with virologic failure on repeat VL as main outcome.

## Results

A total of 172 children were included: 49% female with a median age of 10 years, IQR: 8-12 (Table 1). Among children with VF on first VL, 32.5% had VF on subsequent VL, compared to 7.3% with undetectable VL and 9.1% with LLV (p=0.001). Children with VF were on ART for shorter periods (median 19.8 months, IQR: 10.3-53.3) compared to undetectable children (median 62 months, IQR: 31.3-92.3) and those with LLV (median 65.6 months, IQR: 34.9-88.5) (adjusted Odds Ratio (aOR) 6.8, 95% confidence interval (CI) 2.2-20.5 ). In multivariate analysis, there was no significant difference in subsequent virological failure between LLV and children with undetectable virus at baseline (aOR 1.4, 95% CI 0.3-7.3).

**Table 1. Characteristics and virologic outcomes among children on ART.**

| | Children with undetectable VL | Children with LLV | Children with VF | | |
|---|---|---|---|---|---|
| | 0-39 | 40-999 | 1000+ | Total | P value |
| | 110 (64.0%) | 22 (12.8%) | 40 (23.3%) | 172 | |
| **Sex** | | | | | |
| Female | 57 (51.8%) | 13 (59.1%) | 15 (37.5%) | 85 (49.4%) | 0.187 |
| Male | 53 (48.2%) | 9 (40.9%) | 25 (62.5%) | 87 (50.6%) | |
| **Age category** | | | | | |
| 0-4 years | 8 (7.3%) | 3 (13.6%) | 5 (12.5%) | 16 (9.3%) | 0.538 |
| 5-9 years | 36 (32.7%) | 5 (22.7%) | 9 (22.5%) | 50 (29.1%) | |
| 10-14 years | 66 (60.0%) | 14 (63.6%) | 26 (65.0%) | 106 (61.6%) | |
| **Median age (IQR)** | 10 (8-13) | 10 (7-11) | 12 (6-12.5) | 10 (8-12) | 0.530 |
| **Time on ART (Median in months, IQR)** | 61.2 (30.9-91.0) | 65.6 (34.5-87.3) | 19.6 (10.2-52.6) | 47.6 (21.6-86.2) | 0.001 |
| **Regimen at time of 1st VL** | | | | | |
| NNRTI | 58 (54.2%) | 12 (54.6%) | 21 (52.5%) | 91 (53.9%) | 0.418 |
| PI | 38 (35.5%) | 10 (45.5%) | 13 (32.5%) | 61 (36.1%) | |
| Others | 11 (10.3%) | 0 (0%) | 6 (15.0%) | 17 (10.1%) | |
| **Virologic failure at repeat VL** | | | | | |
| No | 102 (92.7%) | 20 (90.9%) | 27 (67.5%) | 149 (86.6%) | <0.001 |
| Yes | 8 (7.3%) | 2 (9.1%) | 13 (32.5%) | 23 (13.4%) | |
| **Repeat viral load** | | | | | |
| 0-39 | 82 (74.6%) | 13 (59.1%) | 16 (40.0%) | 111 (64.5%) | <0.001 |
| 40-999 | 20 (18.2%) | 7 (31.8%) | 11 (27.5%) | 38 (22.1%) | |
| 1000+ | 8 (7.3%) | 2 (9.1%) | 13 (32.5%) | 23 (13.8%) | |

## Conclusion

Children with virologic failure are at highest risk of continued failure on subsequent viral load. Further studies should evaluate interventions to improve treatment optimization in children with virologic failure and further explore outcomes in children with LLV.
**Future directions:** A study with a larger sample size is needed. While data was collected to examine other factors, such as adherence (reported as "poor/fair/good") and disclosure (the individual's knowledge of his/her condition), presence of data was inconsistent. A study that could examine social factors, utilizing more specific endpoints, would be useful. Studies in other countries and regions are needed to determine the generalizability of our results and examine geographic variations.

## Sources

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