ABSTRACTS ACCEPTED FOR CROI 2016

HEALTH ECONOMICS AND EPIDEMIOLOGY
RESEARCH OFFICE (HE²RO)

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OPTIMISING SOUTH AFRICA’S HIV RESPONSE: RESULTS OF THE HIV AND TB INVESTMENT CASE

**Background:** South Africa’s burden of disease due to HIV and TB is large but matched by the size of the public sector response. We were tasked by the South African government to recommend the optimal mix of interventions to reach national and global HIV and TB targets given limited funding.

**Methods:** After a detailed review process, we selected 27 interventions, 9 factors increasing their technical efficiency, and 13 structural enablers impacting on HIV and/or TB, and parameterised an integrated suite of models including Thembisa, a local HIV transmission model, TIME Impact, a Spectrum-based TB transmission model, and a cost model. For HIV, we analysed the cost effectiveness of the programme at baseline and at current government targets, and developed novel optimisation methodology to identify the most cost-effective combination of interventions under two scenarios: a) the current budget envelope and b) the UNAIDS 90-90-90 targets. We combined each of these with two different TB scenarios: a) baseline and b) the TB 90-90-90 targets. Cost effectiveness was measured as cost per life-year saved over 20 years.

**Results:** Current government policy is relatively efficient but can be further improved (see Table). Under the current budget, the HIV programme could be optimised by scaling up cost-saving interventions (increasing condom availability and access to male medical circumcision and implementing social and behavioural change communication programmes that focus on increasing HIV testing uptake and discouraging multiple sexual partners) and spending the money saved on further scaling up ART. None of the technical efficiency factors except adherence clubs and home-based ART provision were found to be cost saving, and none of the examined structural enablers were able to compete with the other interventions on the basis of HIV endpoints- though both might be needed to reach the 90-90-90 targets. Results differ by province and district. Regarding the TB programme, targets will not be reached with HIV prevention and treatment alone; for this, a comprehensive package of TB and HIV prevention, intensified case finding, diagnosis and high quality treatment is required.

**Conclusions:** Overall, the total cost of the HIV programme will increase regardless of the choice of interventions, but this cost could decrease in the next 10 to 15 years. The total cost of the TB programme however could be reduced after only 5 years of high investments in both the HIV and TB programmes.
INITIATING ART AT A PATIENT'S FIRST CLINIC VISIT: THE RAPIT RANDOMISED TRIAL

Background: Very high rates of patient attrition from HIV care between HIV testing and ART initiation have been documented in sub-Saharan Africa. Our objective was to estimate the effect of accelerated initiation procedures on uptake of ART and viral suppression.

Methods: We conducted a randomized controlled trial (RapIT Trial, NCT01710397) of immediate ART initiation in two public sector clinics in South Africa (a primary health clinic (PHC) and a hospital-based HIV clinic). Adult (≥18), non-pregnant patients receiving a positive HIV test or first CD4 count were randomized to standard or rapid initiation. On the day of HIV test or first CD4 count, rapid arm patients received a point-of-care (POC) CD4 count (Alere Pima) if needed; those ART eligible received a POC TB test (Xpert MTB/RIF) if symptomatic, rapid POC blood tests (Roche Reflotron), physical exam, education, counseling, and ARV dispensing. Patients in the control arm followed standard clinic procedures (3-5 additional clinic visits over 2-6 weeks prior to ARV dispensing). Follow up was by passive medical record review. Primary outcomes were initiation of ART ≤ 90 days and viral suppression, defined as initiated, retained in care, and suppressed (≤400 copies/ml), ≤ 10 months of study enrollment.

Results: Of 600 patients screened, 377 were eligible for ART and for the study (56% female, median age 35, median CD4 count 210 cells/mm3). In the rapid arm 182/187 (97%) initiated ART ≤ 90 days, compared to 136/190 (72%) in the standard arm (RR 1.36; 1.24-1.49). In the rapid arm, 119/187 (64%) initiated and were suppressed at 10 months, compared to 96/190 (51%) in the standard arm (RR 1.26; 1.05-1.50). Adjustment for sex and baseline CD4 count did not affect results. Effects were larger for the PHC than for the hospital-based HIV clinic, for unemployed than for employed patients, and for patients under age 35 than for patients over 35. 72% of rapid arm patients initiated on the same day as HIV test or first CD4 count (Figure 1). All rapid arm patients in the rapid arm who did not start ART ≤ 180 days were delayed due to TB treatment. Time used for treatment initiation in the rapid arm averaged 2.8 hours.

Conclusions: Offering same-day ART initiation to adult patients in South Africa increased uptake of ART by 36% and viral suppression by 26%. It is feasible and acceptable in public sector clinics, and not all POC instruments will be essential in the future. It should be considered for adoption in high-volume clinics in the public sector in Africa.
EFFECT OF ELIMINATING CD4 THRESHOLDS ON NUMBERS OF NEW ART INITIATORS IN SOUTH AFRICA

**Background:** WHO now recommends eliminating CD4 count eligibility criteria for ART, with the goal of expanding the numbers of HIV-infected persons on therapy. Using a novel quasi-experimental method to obtain empirical estimates of the effect of CD4 eligibility on ART uptake, we predict the total number of new ART initiators in South Africa that would result from eliminating CD4 thresholds.

**Methods:** We analyzed clinical records from all patients (n=11,307) in the Hlabisa sub-district public sector ART program with a first CD4 count between August 2011 and December 2012. Using a regression discontinuity design and the 350-cell threshold, we estimated the proportion of patients initiating ART within 6 months due to a Stage 3 or 4 condition, the proportion initiating ART due solely to CD4 count, and the proportion not initiating ART despite being eligible. We also estimated proportions of patients presenting with first CD4 counts <350, 350-500, and >500, and the proportion of all patients initiating within 6 months. Applying these proportions to national (NDoH) data on the number of ART initiators in 2013 (n=614,000), we estimated the number of new initiators per year if CD4 criteria were removed.

**Results:** We estimate that 18% of patients initiated ART due to condition and would initiate under any threshold (Fig., bottom). An additional 25% would initiate if the threshold was increased (Fig, middle) and 57% would not initiate despite having an eligible CD4 count (Fig., top). Under a policy extending eligibility to all patients regardless of CD4 count, just 30% {25%/(25%+57%)} of patients newly eligible would be expected to initiate ART within 6 mo. Of all patients seeking care, 55% (6256) had a first CD4<350 cells; 20% (2223) CD4 350-500 cells; and 25% (2858) CD4>500 cells. Relative to the proportion of all patients initiating within 6 months (32%, 3658), raising the threshold to 500-cells is expected to have increased the number of initiators by 16% {20%*25%/(32%)} Eliminating CD4 criteria will increase new initiators by an additional 17% {25%*25%/(32%*1.16)}. If these numbers hold nationally, then South Africa can expect 98,000 additional initiators per year from raising the threshold to 500 and a further 121,000 initiators per year from eliminating CD4 criteria.

**Conclusions:** Eliminating CD4 criteria would lead to timely ART initiation by an additional 121,000 South Africans (a 4% increase in the total number on ART). Twice that number will enter care and not initiate. Removing CD4 criteria alone, without improving HIV testing, linkage to care, and ART initiation procedures, will not achieve the country’s 90-90-90 targets.
THE REAL WORLD IMPACT OF CD4-ELIGIBILITY CRITERIA ON RETENTION IN HIV CARE

Background: Countries are considering whether to offer antiretroviral therapy (ART) to all HIV patients regardless of CD4 count. Clinical trials have found modest health benefits to early ART. However, these trials may underestimate the benefits. By seeking to minimize attrition, they fail to investigate an important pathway through which deferred ART eligibility may affect health in real world settings: non-retention among patients not yet eligible for therapy. We address this critical gap by assessing the effect of immediate (vs. deferred) ART eligibility on retention in HIV care in rural South Africa.

Methods: All patients (n=11,307) presenting to the public sector ART program in Hlabisa sub-district with a first CD4 count between 12 August 2011 and 31 December 2012 were included in the analysis. Patients were eligible for immediate ART if CD4<350 cells/μL; patients not yet eligible for ART were referred to pre-ART care and instructed to return every 6 months for CD4 monitoring. Because of measurement error in the CD4 laboratory assay, assignment to immediate versus deferred ART was effectively random near the threshold. We use a regression discontinuity design to recover causal effects. We assessed the effect of immediate eligibility on retention in HIV care at 12 months, as measured by the presence of a clinic visit, lab test, or ART start date in the interval 6 to 18 months (intent-to-treat effect). In addition, we assessed the causal effect of eligibility on retention in the subgroup of patients whose treatment uptake was determined by their CD4 count (complier causal effects).

Results: Immediate eligibility increased 12-month retention from 32% to 50% (intent-to-treat effect: 18% points; 95%CI 11-23; p<0.001) among patients with first CD4 counts close to the 350-cell threshold. Having an eligible CD4 count increased the probability of initiating ART within six months from 18% to 43% (25% points; 95%CI 20-31; p<0.001). In patients whose uptake of ART was determined by the value of their CD4 count, having an eligible CD4 count increased 12-month retention from 21% to 91% (complier effect: 70% points; 95%CI 42-98; p < 0.001).

Figure. Intent-to-treat effect: ART eligibility at first CD4 count and 12-month retention in care. Due to measurement error in the CD4 laboratory assay, eligibility for ART was as-good-as-randomly assigned for patients close to the 350-cell threshold. Thus, the difference in retention at the 350-cell threshold can be interpreted as the causal effect of having an eligible CD4 count.
**Conclusions:** Deferred ART eligibility resulted in dramatically lower retention in HIV care among otherwise similar patients who just missed the cutoff for immediate eligibility. The results suggest that clinical trials may underestimate the benefits of early ART and, consequently, the clinical and population health benefits of eliminating CD4 initiation criteria.
CONTINUITY OF CARE AMONG PREGNANT WOMEN LOST TO FOLLOW-UP AFTER INITIATING ART

**Background:** Sub-Saharan African countries are implementing Option B+, but high loss to follow-up (LTF) among women initiating antiretroviral therapy (ART) during pregnancy threatens program success, as well as mother and infant lives. Due to the lack of a national, linked data system in South Africa, LTF estimates cannot account for unreported transfers. We hypothesize that “clinic shopping” and rural-urban travel around delivery may inflate LTF estimates. To test this, we traced lost patients using a national lab database to assess continuity of care and update LTF estimates.

**Methods:** All HIV-positive women initiating ART during pregnancy at 7 clinics in Gauteng Province, South Africa in 2012 and considered LTF (no visit >3 months) were included (N=210). Using combinations of name and date of birth, we manually searched the National Health Laboratory Services Database. Continued HIV care was defined as seeking care at a new facility shown by ≥1 CD4 or viral load test on record, or any record from a different ART clinic, after the last visit at the original clinic. “Clinic shoppers” were defined as seeking care at a different ART facility within Gauteng.

**Results:** Median age and CD4 value at ART initiation was 29 years (interquartile range:25-33) and 240 cells/µl (173-297). Median time between initiation and last clinic visit was 96.5 days (28-287). Records were located for 113 women (n=53.8%). Of these, 74 (65.5%) continued HIV care at a different facility. Most (75.7%) were clinic shoppers; 24.3% sought care in other provinces. Overall median time out of care was 513 days (IQR:339-804). Compared to women who accessed care in other provinces, clinic shoppers stayed out of care longer (median: 582 days, IQR:358-951 vs. 371, IQR:92-543, p=0.04) and median CD4 upon reentry to care trended lower (314 cells/µl, IQR:159-512 vs. 496, IQR:185-547). If all 74 women who continued in care are considered as engaged in care, LTF in the cohort drops from 38.2% to 24.7%.

**Conclusions:** In this pilot study, we found substantial evidence of continued care among women considered LTF after initiating ART during pregnancy. Women sought care at different facilities within the same city and also accessed care in other provinces. This work highlights the difficulty of producing accurate estimates of retention in care and underscores the urgent need for a unique identifier and a national, linked health database. We also found that women are staying out of care for extended periods of time, resulting in continued immunosuppression. More research is needed to explore how women choose HIV facilities, access care and travel around the time of delivery.
DO ART ELIGIBILITY EXPANSIONS CROWD OUT THE SICKEST?
EVIDENCE FROM SOUTH AFRICA

**Background:** In August 2011, South Africa expanded adult antiretroviral therapy (ART) eligibility from CD4 ≤200 to CD4 ≤350 cells/μL. While this policy was designed to increase access, it is possible that an influx of newly eligible patients could have crowded out sicker patients due to clinic capacity constraints. We assessed whether the 2011 eligibility expansion led to treatment delays among those previously eligible in 17 rural clinics and one sub-district hospital in KwaZulu-Natal.

**Methods:** We included all patients seeking care for the first time in the Hlabisa HIV Treatment and Care Programme between February 2011 and February 2012. Our primary outcome was days from registration to ART initiation. We used proportional hazards regression with a regression discontinuity design, controlling for continuous linear trends before and after the policy change, with an indicator to identify a proportional shift in hazards at the time of the policy change. Person-time began at clinic registration and continued until ART initiation, transfer to another clinic, or the end of the study period. Analyses were stratified by first CD4 count to assess direct effects of the expansion on newly eligible patients and spillover effects on patients with CD4 counts < 200 or >350.

**Results:** 1,363 patients registered at the clinics in the six months before the guideline expansion, and 2,467 patients registered in the six months after. Newly eligible patients with CD4 200-350 saw a 109% increase in initiation rates (HR: 2.092; 95%CI 1.52-2.88). Meanwhile, rates did not change for always-eligible patients with first CD4 <200 (HR: 1.14; 95%CI 0.91-1.44), and decreased among never-eligible patients with CD4 >350 (HR: 0.45; 95%CI 0.24-0.85).

**Conclusions:** We found that, in the short term, this ART eligibility expansion successfully increased ART initiation rates among newly eligible patients, and did not bring about negative spillover effects in the always-eligible group. However, the never-eligible group with CD4 >350 did see a decrease in initiation rates, possibly resulting from capacity constraints. It will be important to monitor the long-term impact of eligibility expansions for extended crowd-out effects.
CLINICAL OUTCOMES WITH TENOFOVIR USE IN ART: REGRESSION DISCONTINUITY ANALYSIS

Background: Most countries now recommend initiating HIV patients on tenofovir (TDF) as the standard NRTI in first-line therapy to reduce toxicities associated with the NRTI stavudine. Exploiting national guideline changes in South Africa (SA) and Zambia, we assessed the causal impact of a policy to initiate TDF on ART outcomes using regression discontinuity.

Methods: Prospective cohort study of ART-naïve, non-pregnant, HIV patients >16 years who initiated first-line ART in SA or Zambia (IeDEA-SA). Patients initiating ART +/-12 months around the national guideline changes were included: SA-1 April 2010 and Zambia-1 July 2007. We implemented a regression discontinuity, a quasi-experimental design, using the timing of national guideline changes as natural experiments. Patients initiating just before/after guideline change are similar but receive different regimens. Comparing those patients, we estimated the intent to treat (ITT) effect of guideline change on single-drug substitution (SDS), death, loss to follow-up (LTFU), CD4 response and virologic failure (VF, SA only) in the first 24-months on ART on a risk difference (RD) scale using local linear regression. We excluded patients initiating +/-14 days of the date of the guideline change in all estimates due to imprecision in the implementation of the guidelines. We then collapsed across country to estimate combined ITT effects.

Results: 16,773 South African and 44,399 Zambian patients were eligible. The probability of initiating TDF increased in both countries for patients starting ART after the guideline changes(Figures A and B). ITT estimates showed a significant decrease in the risk of SDS in SA(RD:-14%; 95%CI:-18%,-11%)(Figure C), while we saw no difference in Zambia(Figure D). In both countries we saw no effect on mortality(SA RD:1.0%; 95%CI:-2.2,4.0%; Zambia RD:-0.3%; 95%CI:-2.2,1.5%), LTFU(SA –RD:2.6%; 95%CI:-6.8,1.5%; Zambia RD:-1.0%; 95%CI:-3.4,1.3%), mean CD4(SA RD:10.1; 95%CI:-43.5,23.2; Zambia RD:5.9; 95%CI:-9.1,20.9), or VF in SA(RD:0.0%; 95%CI:-2.1,41.9%). Combined ITT estimates showed a significant increase in TDF (RD:37%; 95%CI:25%,48%) and no difference in outcomes.
Figure. Regression discontinuity showing the probability of receiving tenofovir in South Africa (n=16,773) and Zambia (n=44,399)

**Conclusions:** Guideline changes led to an impressive increase in tenofovir initiation in SA and Zambia. Initiating patients on TDF led to reductions in SDS in SA, suggesting that a global policy to initiate TDF may have resulted in fewer patient-years spent on sub-optimal therapy and fewer patients experiencing side effects/toxicities. No change was observed in other outcomes.
**Background:** Lack of nationally representative data hinders assessment of national HIV treatment programs in many low-resource settings. Where laboratory data are collected on a national scale, such data could be used to create a national monitoring cohort but only if information on treatment initiation can be determined. We developed a novel method to impute dates of antiretroviral treatment (ART) initiation from routine laboratory data in South Africa’s public sector HIV programme that could be applied to a national labs database such as South Africa’s National Health Laboratory Service (NHLS) database and assessed validity of this approach.

**Methods:** We analyzed data from two large clinical HIV cohorts: Hlabisa (rural primary care clinics and one sub-district hospital in KwaZulu-Natal) and Right to Care (network of urban clinics in Gauteng). Both cohorts contain known ART initiation dates and lab test results are imported directly from NHLS. While the ART initiation date for patients was known (gold standard), we imputed ART start dates using only lab data that would be available in a laboratory database. To do this, we identified the date of “ART workup”; the lab tests used to determine treatment readiness in national HIV treatment guidelines (first documented hemoglobin or alanine transaminase test among patients with a CD4 count in the 12 months prior to these tests). We then calculated the median time from the ART workup to ART initiation and imputed ART start date as the date of ART workup plus that median time. We calculated sensitivity (SE), specificity (SP), positive predictive value (PPV), and negative predictive value (NPV) of our imputed start date to be within 6 months of the actual ART start date.

**Results:** We analyzed data from over 80,000 HIV-positive adults of whom >90% had a documented workup. Among patients who had a workup and initiated ART, the median time to initiation was 16 days (IQR 7, 31) in Hlabisa and 21 (IQR 8, 43) in RTC cohort. Among patients with known ART start dates, SE of the imputed start date was 83% in Hlabisa and 88% in RTC, indicating this method will correctly estimate the ART start date for about 85% of those with a recorded ART workup. In Hlabisa, PPV was 95%. SP (100%) and NPV (92%) were also very high.

**Conclusions:** Routine lab data can be used to infer ART initiation dates in South Africa’s public sector with high rates of classification. Lab data can be used to monitor and evaluate health systems performance and improve the accuracy and completeness of clinical records.
A META-ANALYSIS ESTIMATING EARLY MORTALITY ART IN HIV-POSITIVE ADULTS ON ART IN LMIC

**Background:** While scale-up of ART in low- to middle-income countries (LMIC) has decreased mortality amongst HIV patients, it is unclear whether changes in ART guidelines to make more people eligible has decreased early mortality on ART. Previous meta-analyses reported mortality estimates of 12-months post-ART initiation; however, 40-60% of deaths occur in the first 3-months on ART, which is a more sensitive measure of averted deaths through early ART initiation than 12 month rates. We systematically reviewed studies of mortality in the first 3-months post-ART initiation in Asia, sub-Saharan Africa (SSA), and the Americas.

**Methods:** Studies of mortality within 3-months post-ART initiation published in English from January 2003-October 2014 were searched in PubMed, Web of Science, EMBASE and conference abstracts (IAS and AIDS). Articles were included if they were conducted in a LMIC; in a non-trial setting; participants were ≥15 and reported 3-month mortality. Using random effects models (high heterogeneity between studies) we assessed 3-month mortality overall and stratified by region, CD4 count at ART initiation and time.

**Results:** 54 studies were included; 43 (78%) from SSA, 10 (19%) from Asia, 1 (2%) from the Americas. Overall 3-month mortality was 5.9% (95%CI:5.1-6.8%). Mortality for SSA, the Americas and Asia was 5.9% (95%CI:5.0-7.0%), 7.1% (95%CI:6.1-8.1%) and 5.4% (95%CI:4.0-7.1%), respectively (Figure). Studies with a median CD4 >200cells/mm$^3$ at ART initiation had lower mortality (4.4%; 95%CI:3.3-5.6%) vs. studies reporting a median of 100-200cells/mm$^3$ (6.2%; 95%CI:5.0-7.5%) and <100cells/mm$^3$ (8.4%; 95%CI:7.5-10.5%). The overall pooled estimate shows no difference in mortality when comparing studies whose enrollment of patients ended <2010 (5.7%; 95%CI:4.7-6.8%) to ≥2010 (6.2%; 95%CI:4.8-7.8).

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**Figure.** Forest plot of estimates of mortality at 3-months by individual studies and pooled by region.
**Conclusions:** Excluding the Americas, as summary estimates were based on one study, our results showed mortality in the first 3-months on ART were comparable in SSA and Asia. As expected, patients with low CD4 count at ART initiation were at higher risk of death. Our results showed no difference in early mortality over time, potentially due to lack of follow-up time in studies to evaluate the impact after the effect of the 2010 WHO guideline changes. As LMIC increase access to care, raise the CD4 eligibility threshold to 500cells/mm3 or move towards a test-and-treat model of care, the expectation is mortality in the first 3 months on ART will begin to decline.
12-MONTH TREATMENT OUTCOMES AMONGST HIV-POSITIVE ORPHANS AND NON-ORPHANS

Background: The AIDS epidemic has resulted in a large population of orphans in South Africa – without parents, these children may be more at risk of delayed healthcare and poorer outcomes. Little research has investigated treatment outcomes for HIV-positive orphans versus non-orphans; the research that has been done shows mixed results. We sought to evaluate the association between orphan status and antiretroviral treatment (ART) treatment outcomes among HIV-positive infants, children and adolescents initiating ART at 2 large public-sector HIV clinics in Johannesburg, South Africa.

Methods: Retrospective cohort study among HIV-positive infants, children and adolescents aged one month to 18 years initiating on standard first-line ART between June 2004-May 2013. We used modified Poisson regression to evaluate the association of orphan status with all-cause mortality, loss to follow-up (LTF;≥3 months late for a scheduled visit) and having a detectable viral load (≥400 copies/ml) at 12 months on ART.

Results: We included 244 (27.1%) patients classified as orphans (either maternal, paternal or both) and 658 (72.9%) as non-orphans at ART initiation in our analysis. Median ages were 8.5 years (IQR:5.2-11.6) and 3.0 years (IQR:1.0-7.4) for orphans and non-orphans, respectively. At ART initiation about 36% were classified as WHO stage III/IV and 17% had TB. A total of 1 (0.4%) orphan and 16 (2.4%) non-orphans died in the first 12 months following ART initiation while 7.8% and 17.8% of orphans and non-orphans were LTF. A total of 37 (18.7%) orphans and 133 (29.4%) non-orphans had a detectable viral load after 12 months on ART. Adjusted modified Poisson regression (Table 1) showed that being an orphan has a protective effect on the risk of death (RR 0.26;95%CI:0.20-0.35), risk of LTF (0.60;95%CI:0.44-0.82) and risk of failure to achieve viral suppression (0.77;95%CI:0.70-0.84) when compared to non-orphans.

Conclusions: Results show that orphans were less likely to die, be lost to follow-up and fail to achieve viral suppression. This surprising result needs to be analysed further, but may arise from orphans being more integrated into care due to orphan-specific programming or foster care. Understanding the impact of orphan status on short- and long-term ART outcomes could improve targeted strategies, and subsequent treatment and developmental outcomes, for HIV-positive infants, children and adolescents. Additional research investigating age-specific outcomes will be important to further elucidate these effects.
Table 1. Adjusted predictors of mortality, loss to follow up and viral suppression among infants, children and adolescents 12 months after initiating ART

<table>
<thead>
<tr>
<th></th>
<th>Mortality (n=17)</th>
<th>Loss to follow-Up (n=136)</th>
<th>Failure to achieve viral suppression (n=170)</th>
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<tbody>
<tr>
<td><strong>Orphan status at ART initiation</strong></td>
<td></td>
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<tr>
<td>Non-orphan</td>
<td>Reference</td>
<td>Reference</td>
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<tr>
<td>Orphan</td>
<td>0.26 (0.20-0.35)</td>
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<td>0.77 (0.70-0.84)</td>
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<tr>
<td><strong>Sex</strong></td>
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<td>Reference</td>
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<tr>
<td>Male</td>
<td>0.95 (0.47-1.92)</td>
<td>0.94 (0.81-1.09)</td>
<td>1.08 (1.00-1.16)</td>
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<tr>
<td><strong>Age at ART initiation (years)</strong></td>
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<tr>
<td>&lt; 1 year</td>
<td>0.94 (0.40-2.22)</td>
<td>1.06 (0.83-1.36)</td>
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<td>1 to 4.9</td>
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<td>5 to 9.9</td>
<td>0.47 (0.40-0.55)</td>
<td>0.51 (0.30-0.85)</td>
<td>0.65 (0.27-1.56)</td>
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<td>≥ 10 years</td>
<td>0.60 (0.26-1.33)</td>
<td>0.40 (0.18-0.86)</td>
<td>0.99 (0.88-1.12)</td>
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<td><strong>CD4 classification at ART initiation</strong>*</td>
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<td>Very low</td>
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<td>1.78 (1.69-1.89)</td>
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<td>Low</td>
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<td><strong>Hb at ART initiation (ug/dL)</strong></td>
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<td>&lt; 10</td>
<td>Reference</td>
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<tr>
<td>≥ 10</td>
<td>0.64 (0.59-0.69)</td>
<td>0.99 (0.71-1.36)</td>
<td>0.96 (0.78-1.19)</td>
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<td><strong>WHO clinical stage at ART initiation</strong></td>
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<tr>
<td>I or II</td>
<td>Reference</td>
<td>Reference</td>
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<tr>
<td>III or IV</td>
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<td>0.82 (0.73-0.92)</td>
<td>1.21 (1.10-1.32)</td>
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<td>Stavudine (d4T) or Zidovudine (AZT)</td>
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<tr>
<td>Abacavir (ABC) or Tenofovir (TDF)</td>
<td>0.41 (0.21-0.79)</td>
<td>1.18 (1.11-1.24)</td>
<td>2.56 (1.88-3.48)</td>
</tr>
<tr>
<td><strong>PI</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>Reference</td>
<td>Reference</td>
<td>Reference</td>
</tr>
<tr>
<td>Yes</td>
<td>1.89 (0.90-3.99)</td>
<td>0.69 (0.68-0.70)</td>
<td>0.97 (0.96-0.99)</td>
</tr>
</tbody>
</table>

*CD4 classification as follows: Very low CD4:<5% for <6 and <25 cells/mm3 for ≥6; Low CD4:5-15% for <6 and 25-50 cells/mm3 for ≥6; Moderate CD4:15-25% for <6 and 50-200 cells/mm3 for ≥6; High CD4:>25% for <6 and >200 cells/mm3 for ≥6

**PI is either Lopinavir or Ritonavir
MEASURING VIRAL LOAD SUPPRESSION IN SOUTH AFRICA USING A NOVEL, NATIONAL DATABASE

Background: South Africa has embraced UNAIDS’ ambitious goal of 90% of people on antiretroviral treatment (ART) having a suppressed viral load (VL). One strategy has been to decentralize ART services by down-referring patients to smaller facilities, supported by the Nurse Initiated and Managed ART program. There is limited information on VL suppression levels among ART patients and on outcomes by site of care. Using a novel patient matching algorithm, we merged 2 existing databases to create a national marker of VL suppression for all clinics in South Africa to monitor ART effectiveness and understand influences of clinic success.

Methods: The National Health Laboratory Services’ database, which contains all public sector VL tests in South Africa by facility, was merged with the District Health Information System database, which reports on the Total number of patients Remaining on ART (TROA) by facility. We analyzed the last VL test of patients in a 12-month period for each facility. We used the TROA to categorize facility size into quartiles. We report the proportion of patients receiving a VL test in a 12-month period, the results of those tests (<400, 400-1000, >1000, and >10,000 copies(cp)/ml) and how these differ by province and facility size.

Results: From April 2014-March 2015, 3,775 public facilities reported 2,993,125 patients on ART. During the same period, 2,199,890 unique patients received 2,995,133 VL tests. Nationally, 75% of ART patients had a VL test in the last 12 months and 78% were suppressed (VL <400 cp/ml). 19% and 12% of patients had a VL >1000 and >10000 cp/ml respectively. The proportion of patients with a suppressed VL ranged from 69 to 82% across provinces (Table 1). In 3 provinces, ≥25% of patients had a VL result >1000 cp/ml. VL suppression was associated with facility size (TROA), controlling for % of patients tested and province. Two-thirds of all ART patients are seen in the 25% largest facilities and a greater proportion of them were VL suppressed compared to those seen in the 25% smallest facilities (difference of 14.5% (95% CI: 13.1-15.9)). Overall, 3.7% of facilities met the 90% target for VL suppression and these were distributed across facilities of all sizes.

Conclusions: There is great geographic diversity in VL testing and suppression levels in South Africa. While most facilities need to increase the proportion of patients tested and suppressed, utilizing VL suppression data to target interventions will help South Africa reach the 90% viral suppression goal.