

Does Continuous Quality Improvement Improve PMTCT Processes in rural South Africa? A Stepped-Wedge Cluster RCT.

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1. Background

- Health systems imperfections continue to lead to preventable HIV vertical transmission in many countries
- South Africa is the highest HIV burden country in the world
 - national antenatal HIV prevalence is ~30%^[1]
 - ~4-4.8% women seroconvert during pregnancy and postpartum^[2,3]
- Universal HIV testing and fully suppressive antiretroviral therapy (ART) are needed for maternal health and prevention of mother-to-child transmission of HIV (PMTCT)^[4]
- Repeat HIV testing and viral load (VL) monitoring of pregnant/breastfeeding women are key process elements to optimise PMTCT programme success
- Continuous Quality Improvement (CQI) aims to improve health care equity within a given set of resources^[5]
- Rigorous scientific evidence for CQI is lacking in resource-limited settings, particularly in primary care services
- We conducted a clinical trial in rural South Africa to investigate whether a CQI intervention could improve the:
 - [1] proportion of HIV-positive pregnant women with an antenatal VL test; and
 - [2] proportion of HIV-negative pregnant women with at least one repeat HIV screening test

2. Methods

The MONARCH trial (NCT02626351) was a stepped-wedge cluster randomised controlled trial conducted in northern KwaZulu-Natal, South Africa, from July 2015 to January 2017. Ethical approval was obtained from the University of KwaZulu-Natal Biomedical Research Ethics Committee.

- We delivered a CQI intervention using standardized tools such as Plan-Do-Study-Act cycles and Run Charts, targeted at antenatal health care providers
- CQI training and mentorship were provided by the Centre for Rural Health, University of KwaZulu-Natal
- The trial design was selected for ethical and pragmatic reasons
- Randomization was restricted by cluster size (small, medium, large)
- All clinics provided baseline data until randomly rolled over to the intervention which was delivered in 6 steps (Figure 2).
- All women aged ≥ 18 years who delivered during the study were eligible for outcome measures
- Data were extracted from routine antenatal medical records at delivery
- We performed intent-to-treat (ITT) analyses using Poisson mixed effects models, with time fixed effects to control for secular trends, and clinic random effects in Stata 15. ITT was based on 1st booking visit attendance at a study clinic for antenatal care

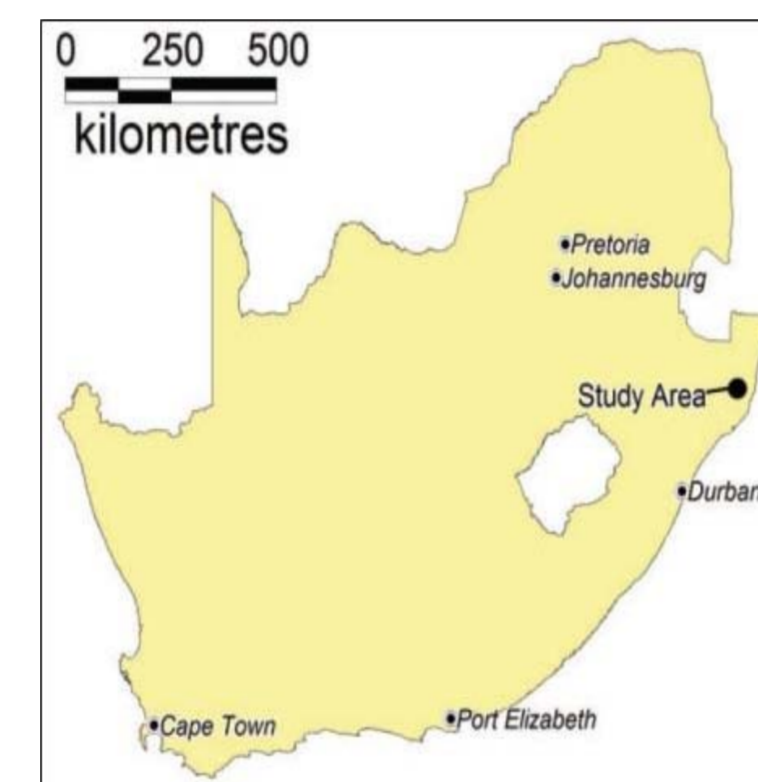


Figure 1. The study area is located within the AHRI Population Intervention Platform Surveillance Area, ~220 km north of Durban.

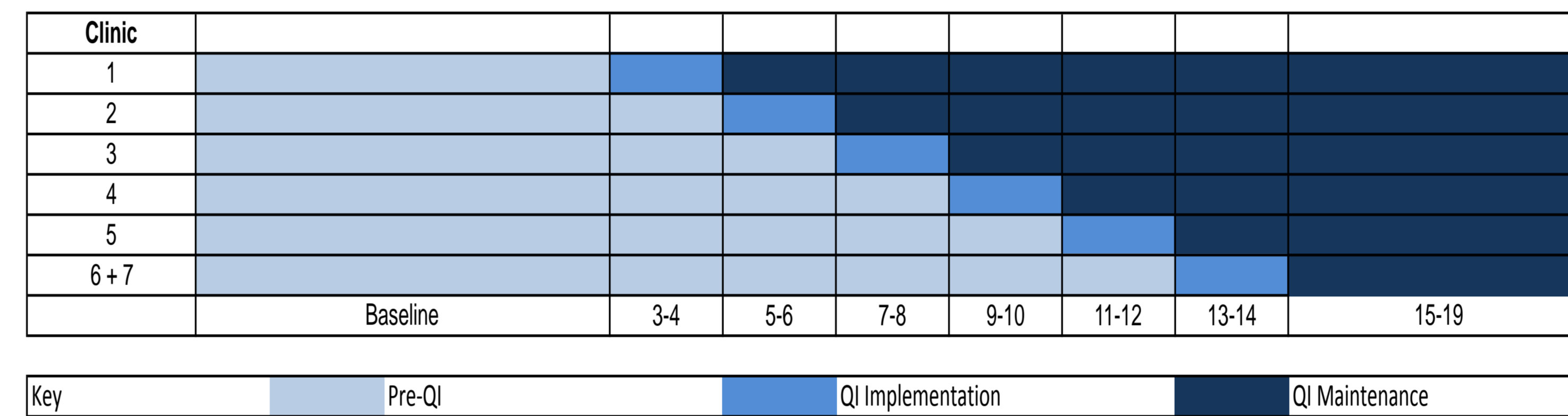


Figure 2. The stepped wedge study design. The 7 clinics were combined into 6 intervention steps, with the 2 smallest clinics merged into a single intervention cluster. Each intervention step was 2-months' duration. Baseline data covered ~7 months and the post-intervention phase ~4.5 months. All clinics provided data continuously over the study period.

3. Participant flow

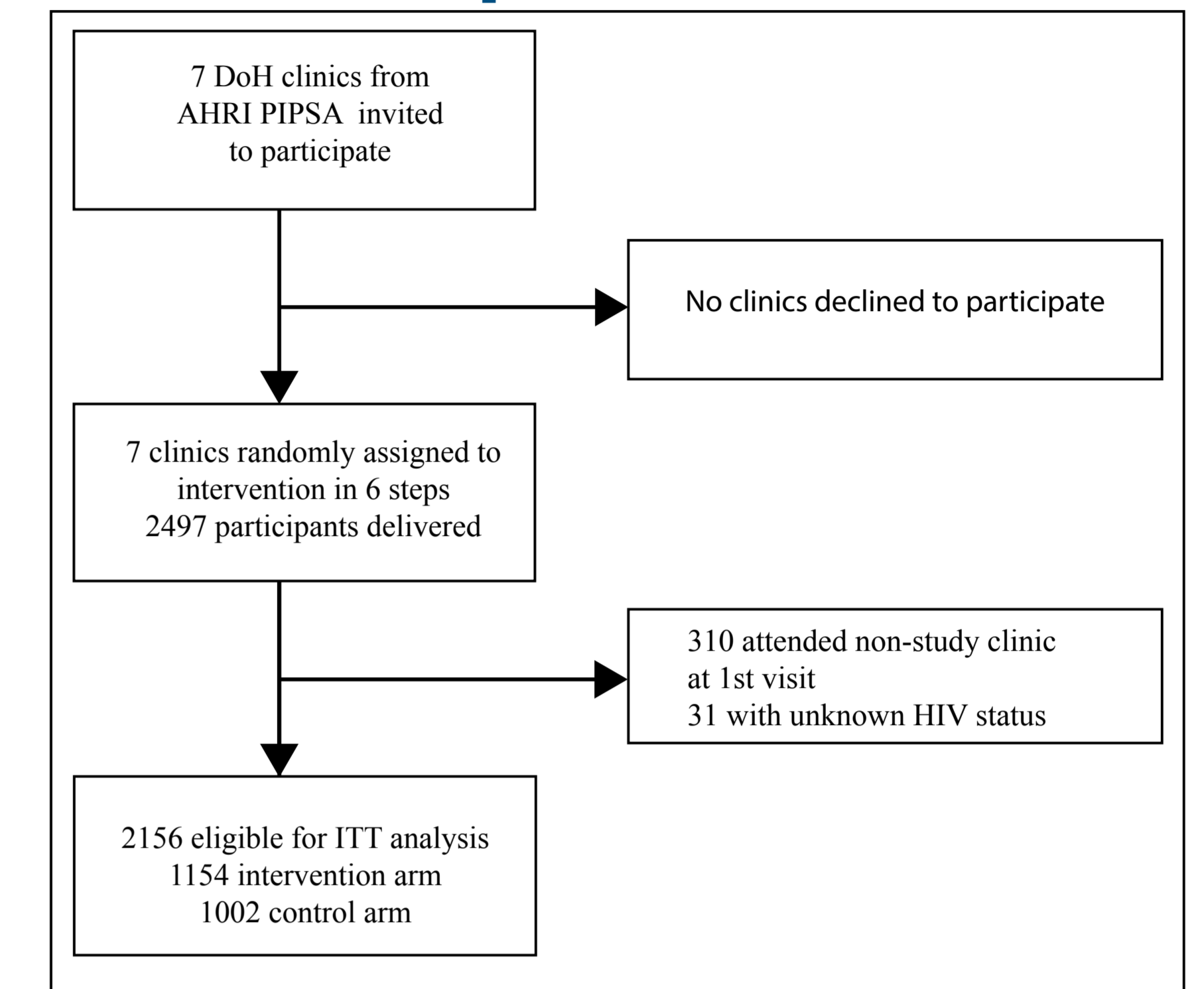


Figure 3. Participant flow diagram.

- HIV VL outcome (CQI exposed and unexposed): 1027 women, including seroconverters, analysed
- Repeat HIV screening outcome (CQI exposed and unexposed): 1146 women with an initial negative HIV test analysed

4. HIV prevalence by age

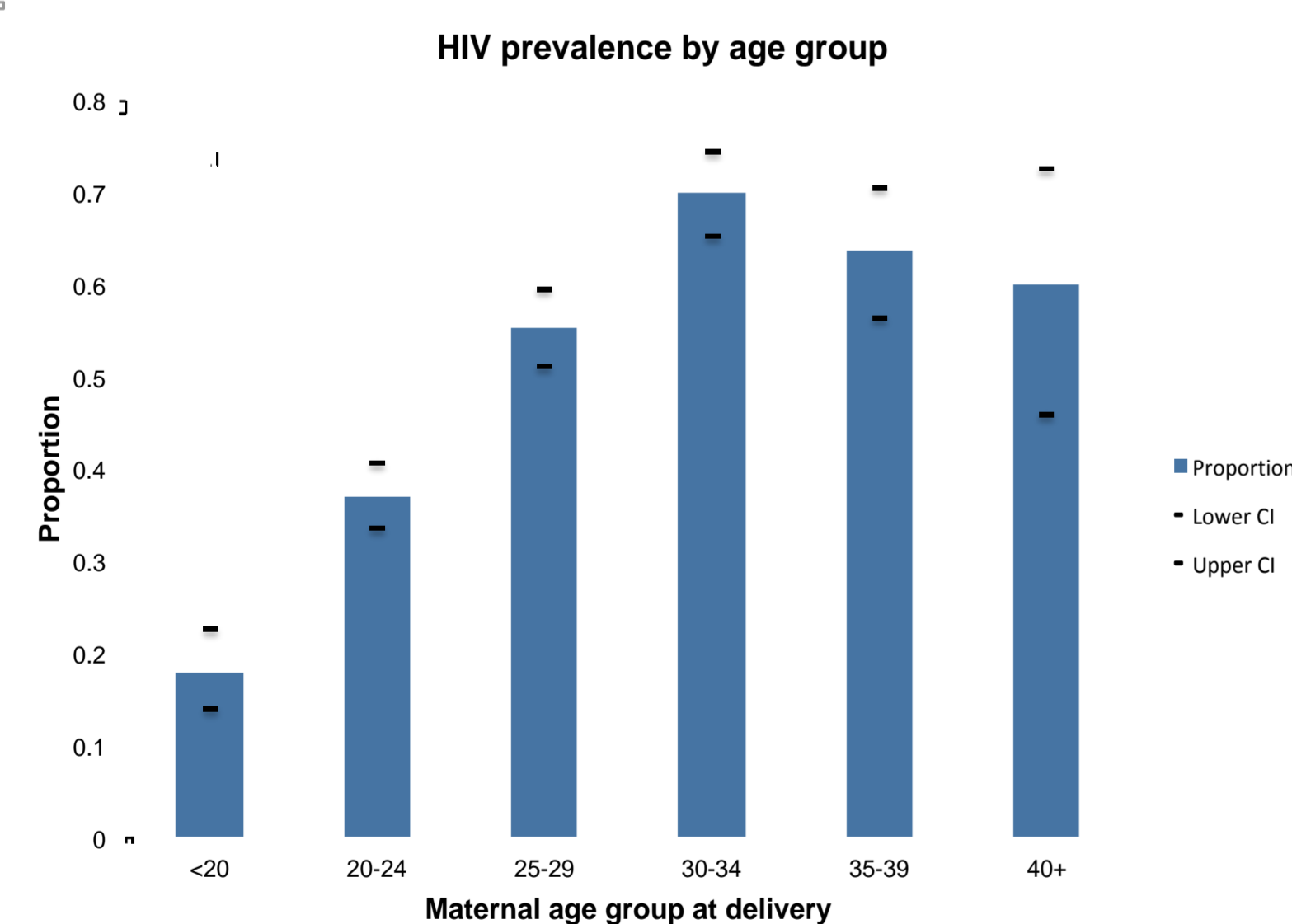


Figure 4. HIV prevalence in pregnant women by age group.

- Overall HIV prevalence including seroconverters was 47.5% (95% confidence interval, CI, 45.4-49.6%)
- Median maternal age: 25 years (interquartile range, IQR, 21-30)
- Median gestational age at 1st antenatal booking visit: 19 weeks (IQR 15-24)

5. Outcome descriptions

- HIV-positive pregnant women (n=1027)**
 - ART coverage at any stage was 92.9% (95% CI 91.1-94.3%)
 - 55.4% (95% CI 48.7-61.9%) of HIV-positive pregnant women had a VL performed ever in pregnancy
 - 52.2% had a result documented, of which 85.5% (95% CI 78.0-90.7%) were <200 copies/mL
 - 38.8% (95% CI 33.2-44.6%) had a VL within 3 months of delivery
 - 38.0% had a result documented, of which 84.8% (95% CI 78.0-89.7%) were <200 copies/mL
- HIV-negative pregnant women (n=1146)**
 - 17/1146 women with an initial negative HIV test seroconverted to HIV (1.5%, 95% CI 0.9-2.4%)
 - 66.9% of women (95% CI 58.9-74.1%) with an initial negative HIV test had at least 1 repeat HIV screen ever in pregnancy
 - 63.4% (95% CI 55.4-70.6%) had a repeat HIV test within 3 months of delivery

6. Impact of CQI on PMTCT processes

- VL outcome:** those exposed to CQI vs. those unexposed: aRR[§] = 1.42 (p=0.016)
- Repeat HIV screening outcome:** those exposed to CQI vs. those unexposed: aRR[§] 0.89, p=0.283

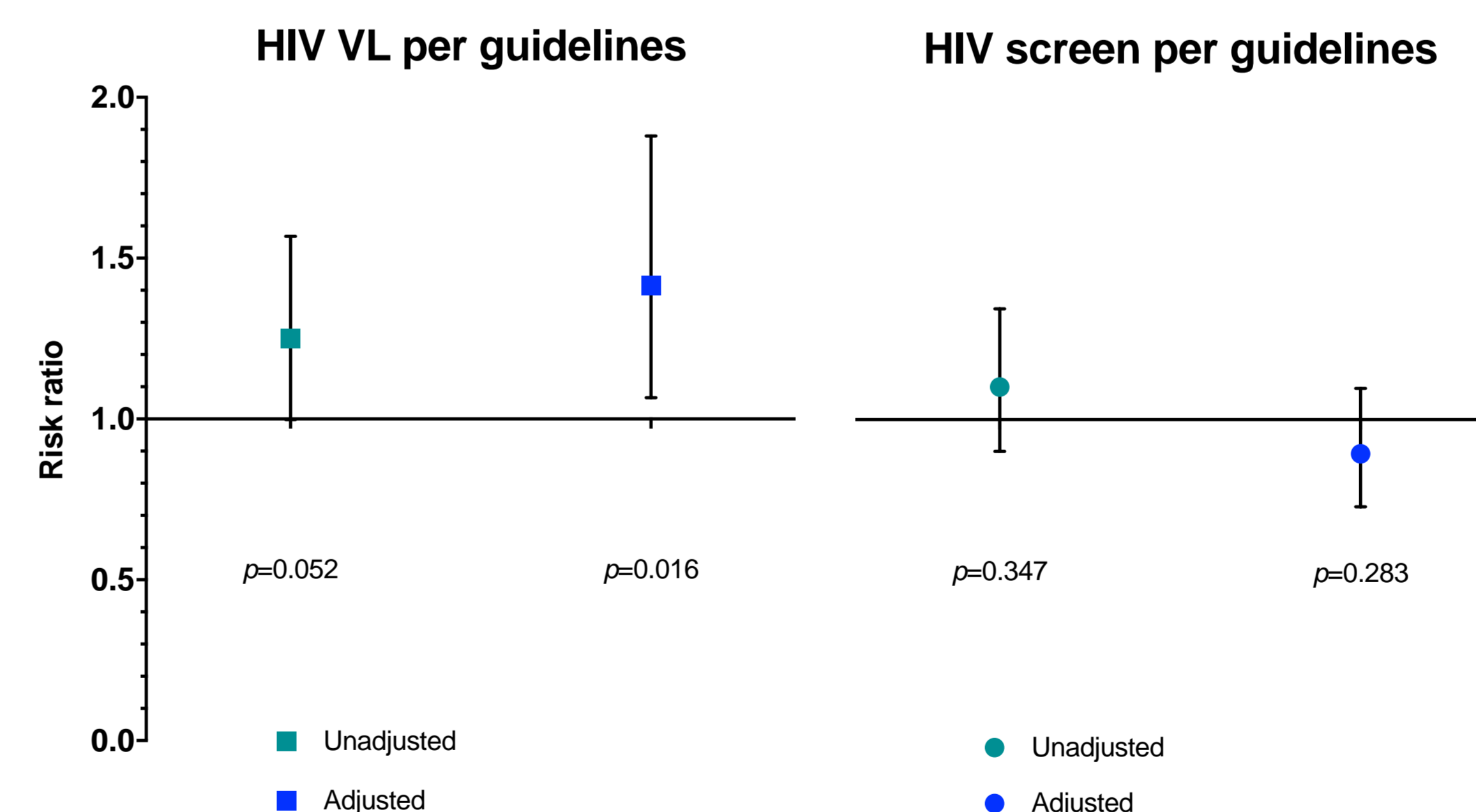


Figure 5. Risk of reaching HIV VL and repeat HIV screening outcomes in pregnant women. *All models include fixed effects for time step, random effects for clinic and cluster robust standard errors. [§]Adjusted models additionally include covariates for gestation, maternal age, parity, number of clinic visits, and a clinic-time random interaction effect.

7. Conclusions

- CQI had a positive impact on increasing HIV VL testing but not repeat HIV screening after adjusting for secular trends and gestational age
- However overall VL and repeat HIV screening rates fall well short of expected targets needed for virtual elimination of MTCT (eMTCT)
- VL suppression rates in those with documented results were encouraging, although results documentation was often incomplete
- Poor results documentation raises concerns about missing pregnant women with virologic failure
- Achieving eMTCT in this high HIV prevalence setting is likely to require concurrent health systems improvements
- Long term sustainability of CQI in resource-limited settings is unknown and requires further study



Acknowledgements

The MONARCH project was funded by the Delegation of the European Commission to South Africa, EuropeAid/134286/L/ACT/ZA. The contents of this document are the sole responsibility of authors and their affiliated institutions, and can under no circumstances be regarded as reflecting the position of the European Union. HMNY is supported by an Australian Government Research Training Program Scholarship, University of New South Wales, Sydney, Australia. The Kirby Institute is funded by the Australian Government Department of Health and Ageing, and is affiliated with the Faculty of Medicine, UNSW Sydney. AHRI receives core funding from the UK Wellcome Trust grant 082384/Z/07/Z and Howard Hughes Medical Institute.

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