Clinical Trial/Experimental Study

Medicine

OPEN

Motivational interviewing retention counseling and adherence to early infant diagnostic HIV testing schedule in South Africa

The PAEDLINK randomized trial

Dorina Onoya, PhD[a,*], Nelly Jinga, MPhil[a], Cornelius Nattey, MSc[a], Constance Mongwenyana, MA[a], Sithabile Mngadi, MA[a], William B. MacLeod, ScD[a,b], Gayle Sherman, PhD[c]

Abstract

Introduction: We report the PAEDLINK randomized trial results on the effect of motivational interviewing (MI) retention counseling on the adherence of postpartum women to the early infant diagnostic human immunodeficiency virus (HIV) testing schedule.

Methods: HIV positive women and their babies were enrolled 3 to 6days after delivery at 4 midwife obstetric units in the Gauteng province of South Africa and randomized into (A) MI retention counseling and telephonic tracing, (B) biannual telephonic tracing, and (C) standard care. Mother-baby pairs were followed up for 18 months via medical records. The uptake of child HIV tests and maternal retention in the 0 to 6 and 7 to 18month periods were modeled using Log-binomial regression.

Results: Overall, 501/711 enrolled mother-baby pairs received a second HIV polymerase chain reaction test by 6 months (70.0%, 70.5%, and 70.0% in groups A, B, and C, respectively). A higher proportion of intervention children (60.9%) were tested at 7 to 90 days than group B (48.1%, adjusted risk ratio [aRR] 0.8 for B vs A, 95% confidence interval [CI]: 0.7–0.9) and group C children (52.7%, aRR0.9 for C vs A, 95% CI: 0.9–1.0). Child testing between 7 and 18-months was also higher in group A than C (10.7% A, vs 5.5% C, RR 2.0, 95% CI: 1.0–3.7). However, maternal retention was similar across groups, with 41.6% and 16.3% retained during the 0 to 6 and the 7 to 18-months periods, respectively.

Conclusion: MI retention counseling can reduce delays in the early infant diagnosis testing schedule for HIV-exposed infants. However, further support is necessary to maximize later HIV tests and maternal retention.

Abbreviations: ANC = antenatal care, ART= antiretroviral therapy, CI = confidence interval, CONSORT = Consolidated Standards of Reporting Trials, EID = early infant diagnosis, HIV = human immunodeficiency virus, IQR = inter quartile range, MI = motivational interviewing, MOU = midwife obstetric unit, PCR = polymerase chain reaction, RR = risk ratio, SA = South Africa.

Keywords: early infant diagnosis, human immunodeficiency virus, motivational interviewing counseling, South Africa

Editor: Chiedu Eseadi.

This project was supported by United States Agency for International Development under the terms of Cooperative Agreement 674-A-12-00029 to the Health Economics and Epidemiology Research Office, by the National Research Foundation of South Africa (grant number 99297) and by Collaborative Initiative for Paediatric HIV Education and Research (CIPHER) (ref: 353-ONO). Its contents are solely the authors' responsibility and do not necessarily represent the official views of the United States Agency for International Development, CIPHER, or the NRF.

The authors have no conflicts of interests to disclose.

The datasets generated during and/or analyzed during the current study are not publicly available, but are available from the corresponding author on reasonable request.

[a] Health Economics and Epidemiology Research Office, Department of Internal Medicine, School of Clinical Medicine, Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, South Africa, [b] Department of Global Health, Boston University School of Public Health, Boston, MA, [c] Department of Paediatrics and Child Health, School of Clinical Medicine, Faculty of Health Sciences, University of the Witwatersrand and National Institute for Communicable Diseases, a division of the National Health Laboratory Services, Johannesburg, South Africa.

[*] Correspondence: Dorina Onoya, Health Economics and Epidemiology Research Office, 39 Empire Road, Parktown, Johannesburg, 2193, South Africa (e-mail: donoya@heroza.org).

How to cite this article: Onoya D, Jinga N, Nattey C, Mongwenyana C, Mngadi S, MacLeod WB, Sherman G. Motivational interviewing retention counseling and adherence to early infant diagnostic HIV testing schedule in South Africa: the PAEDLINK randomized trial.Medicine 2022;101:6(e28730).

Received: 9 March 2021 / Received in final form: 10 January 2022 / Accepted: 13 January 2022

http://dx.doi.org/10.1097/MD.0000000000028730

1. Introduction

The risk of vertical transmission of the human immunodeficiency virus (HIV) in South Africa (SA) gradually declined from 25% to 30% by 6-week, before 2001, to 1.5% in 2016, and 0.7% by 10 weeks in 2019.[1–5] However, more efforts are required to maximize the survival of HIV infected children by reducing delays in HIV diagnosis and antiretroviral therapy (ART) initiation.[6,7] Non-adherence to the early infant HIV diagnostic (EID) HIV test schedule delay HIV diagnosis and ART initiation of HIV infected children and the accuracy of vertical HIV transmission estimates in South Africa.[6,8–10]

In 2015, the SA EID testing schedule for HIV-exposed infants included an HIV polymerase chain reaction (PCR) at birth and 10 weeks of age and a rapid antibody test at 6 weeks post-cessation of breastfeeding and/or at 18 months.[4] The proportion of babies tested at birth to over 90% in 2016.[11] The median ART initiation age in South Africa also gradually declined from 68 days in the 2006 to 2009 period to 45 days in 2013 to 2017.[7] The EID guidelines were updated in 2019 to include an HIV PCR test at 6 months and an antibody test at 18 months for all children regardless of known HIV exposure.[12–14] However, the uptake of the 10-week PCR and the 18-month antibody tests remains unclear.

Losses of HIV exposed infants from the EID schedule is systemic in Sub-Saharan Africa, with up to 50% lost by 6 months.[15] However, prevention of mother to child transmission interventions focus primarily on increasing early maternal attendance of antenatal care (ANC) services with limited messaging and evidence of their effect on maternal adherence to the EID schedule.[16,17]

Patient-centered counseling interventions are essential to improve prevention of mother to child transmission outcomes, considering the unique trajectory of each mother–child pair in the postpartum period.[18] There is increasing evidence to support the beneficial effect of brief behavior change interventions, including motivation interviewing (MI) techniques in preventing risky sexual behaviour, HIV, and unintended pregnancies in low and middle-income settings.[19–21] However, very little data exists on its use in improving adherence to the EID testing schedule.[22] This study aimed to test the effect of an MI-based brief retention counseling on maternal retention for their own health and the adherence to the EID testing schedule for HIV exposed infants in the Gauteng province of South Africa.

2. Materials and methods

2.1. Study design and population

This was a randomized controlled trial conducted among adult (≥18 years) HIV positive mothers, and their HIV uninfected babies enrolled at 4 midwife obstetric units (MOUs) in Tshwane and Ekurhuleni districts of the Gauteng province of South Africa (Pan African Clinical Trials Registry https://pactr.samrc.ac.za/ Ref: PACTR201809886446171). Mother and baby dyads were recruited consecutively via referrals from MOU midwives and interviewed immediately after the postnatal consultation (scheduled 3 to 6 days after delivery). We included mothers who were well enough to complete a questionnaire, willing to consent to the telephonic tracing of mother and baby, as well as medical records reviews at 6, 12, and 18 months postpartum. We excluded women with babies over 2 months old. Participants were screened and interviewed in English, Sotho, and Zulu with written consent secured before randomization.

Study enrollment was conducted from October 2016 to January 2018. Follow-up activities continued until the end of June 2019. Participants randomized to receive telephonic followup received R30 airtime vouchers after telephonic follow-up interviews as an incentive for accepting phone calls from study interviewers.

2.1.1. Sample size. This study was a prospective extension of a retrospective cohort study aiming to determine the rate of early ANC initiation among HIV positive women enrolled 3 to 6 days postpartum. The sample was determined based on the fact that 30% of South Africa pregnant women who test HIV positive during antenatal care had a previous HIV positive diagnosis, and only 40% of South African women attend ANC before the recommended 14 weeks gestation.[7,19,20] Beyond the aims of the retrospective cohort study, we sought as a total sample of 920 HIV positive women to detect a 20% difference in the uptake of the child HIV PCR test between the intervention (A) and the standard care arm of the study using an alpha (α) of 0.05, 80% power, and a 1:1:1 allocation ratio.

2.2. Randomization procedure

Participants were randomized in a 1:1:1 ratio using balanced block randomization[23] (block size 20) to either (A) MI retention counseling with telephonic counseling and tracing, (B) telephonic tracing, or (C) passive tracing (standard of care). Randomization was un-blinded for all groups. While all participants consented to receive counseling sessions and telephone calls, participants were aware when these did not occur. Participants study number were issued consecutively and pre-allocated to the study arms. Randomization occurred after the completion of the baseline interview by the study assistant at participating sites. While participants were assigned study IDs after consenting to participate, the allocation was only revealed after the questionnaire was administered.

2.2.1. (A) MI retention counseling with active telephonic tracing. The intervention was based on the information motivational and behavioral skills model.[21] The information motivation and behavior theory model depends on adequately skilled and motivated patients to overcome behavioral challenges and exploit opportunities to follow HIV-specific recommendations. Lay counsellors were trained on MI techniques using the brief negotiated interviewing online training tools before the study started and again before the 6- and 12-months follow-up telephonic counseling sessions.[24] Mothers received the brief face-to-face baseline MI-based counseling immediately after the clinic consultation and the telephonic counseling at 6 and 12 months postpartum. Counseling took about 15 to 30 minutes and was conducted in Sotho, Zulu, or English. The counseling messages centered on strengthening mothers' intentions and selfefficacy to remain in HIV care and adhere to the EID testing schedule for their HIV exposed infants. The telephonic counseling sessions were audio-recorded for training and fidelity management purposes.

2.2.2. (B) Active telephonic tracing. Group B women were interviewed in person at baseline and telephonically at 6 and 12-months. No counseling or advice was offered to this group.

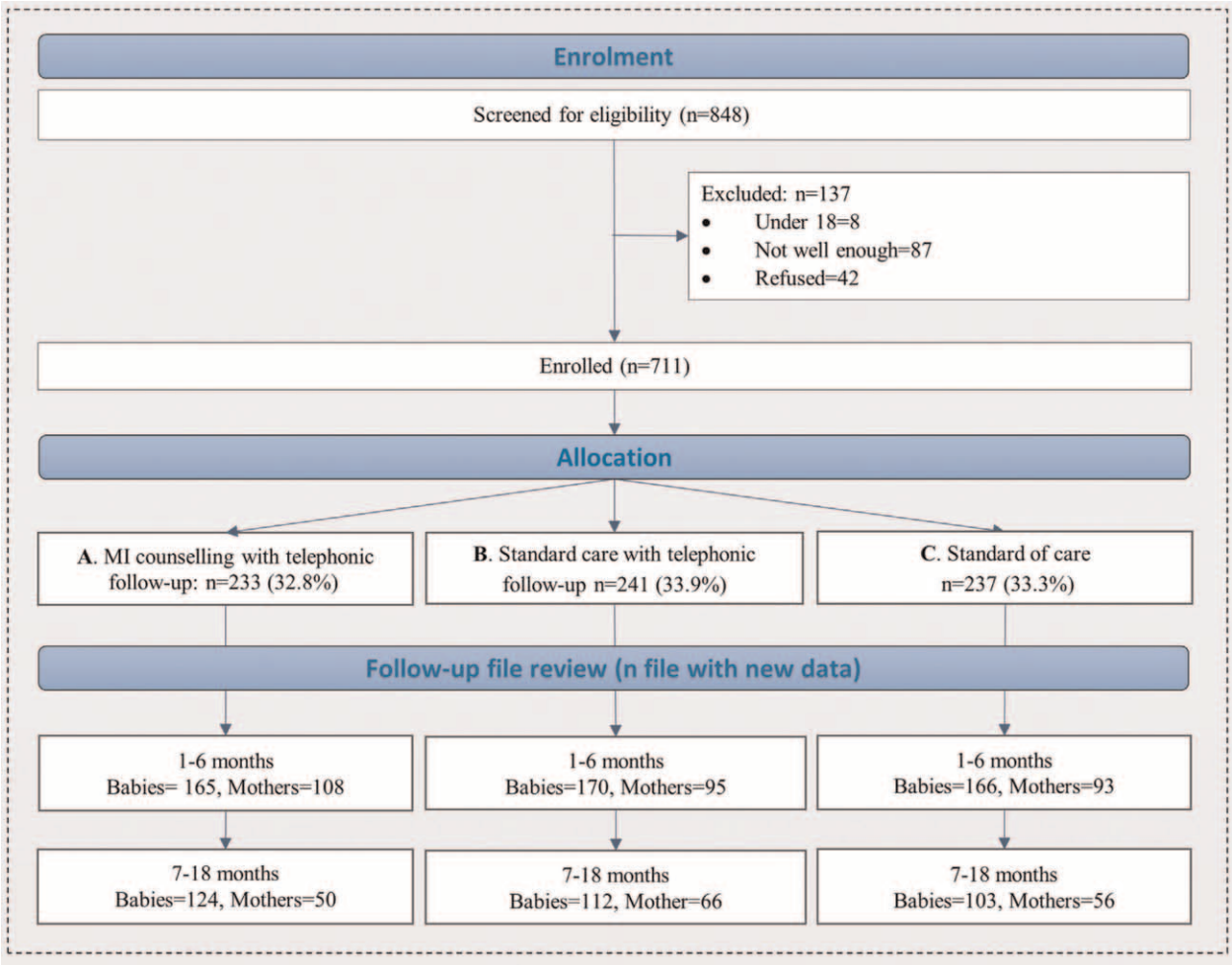

Figure 1. CONSORT diagram of participant enrolment, randomization, and follow-up in the postpartum study.

2.2.3. (C) Passive tracing (standard of care). There was no further direct contact with group C participants after the baseline interview.

2.3. Data collection

2.3.1. Baseline. Female interviewers administered the questionnaire, collecting data on demographic, socio-economic factors, and postpartum mobility plans. HIV knowledge was measured using a 12 item index, with the total knowledge scores categorised as "Low to medium" (score ≤ 8) or "Medium to high" (score >8). Perceived social support (PSS) was measured using a 6-item scale in which participants indicated their overall level of satisfaction with available support given in each area.[24] Postpartum depression was measured using the Center for Epidemiologic Studies Depression scale, a 10-question 4-point scale (scores range 0–3) that measures general depression up to 7 days before the interview date (Cronbach $\alpha = 0.83$, range: 030),[24–26] categorized into no depression (Center for Epidemiologic Studies Depression scale total score <5), low to medium (total score ≥ 5 and <10), and major depression (total score ≥ 10).[27,28] Additionally, antenatal and obstetric data were collected from mothers' records at birthing sites.

2.3.2. Follow-up. The follow-up questionnaire collected information on linkage to and retention of mother–child pairs in postpartum HIV care. Mother–baby pairs were further followed up via medical records at 6, 12, and 18 months at up to 25 primary healthcare clinics (Figs. 1 and 2). We searched for HIV PCR, viral load test, and patient visit data in the Three Interlinked Electronic Registers for Tuberculosis & HIV (TIER.Net) and the National Health Laboratory Service databases.

The final dataset was de-identified before the statistical analysis. This study was approved by the ethics committee of the University of the Witwatersrand Human Research Ethics Committee (Medical) (HREC No. M151041).

2.4. Analytic variables

2.4.1. Primary outcome. The overall median time from delivery to study enrolment was 4 days (interquartile range [IQR]: 3–6). The secondary study outcome was the uptake of the second infant HIV PCR test from 7 days to 6 months of life and also determined if an exit antibody test was conducted between 7 and 18 months.

2.4.2. Secondary outcome. The primary outcome was maternal retention (evidence of clinic attendance) in HIV care for her

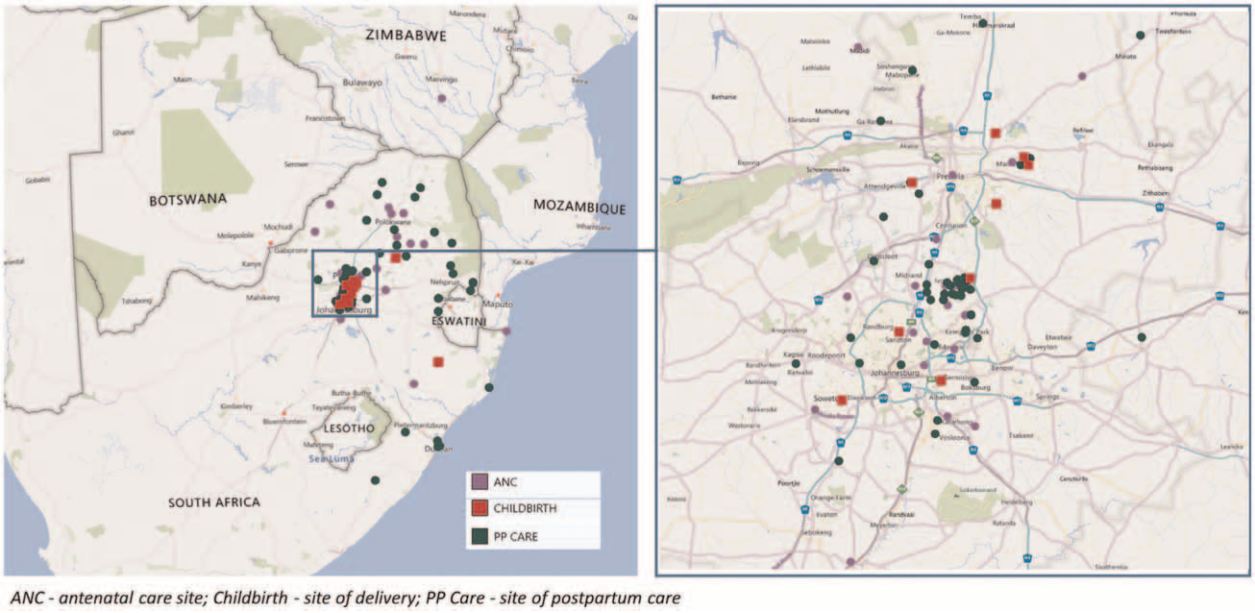

Figure 2. Map of ANC, childbirth, and postpartum care among the participating HIV positive mother. ANC = antenatal care, HIV = human immunodeficiency virus.

own health, up to 6 months postpartum and in the 7 to 18 months postpartum period.

2.5. Statistical analysis

Categorical variables were summarized using frequencies, percentages with 95% confidence intervals (95% CI). Continuous variables were described using medians and IQR. Adjusted Log-binomial regression model was used to estimate risk ratio (RR) and predictors for maternal retention (7 days to 6 months postpartum), overall 10-weeks (7 days to 6 months) infant HIV PCR test uptake and on-time second PCR uptake (7–90 days). Data analysis was conducted using STATA version 14 (StataCorp, College Station, TX).

3. Results

We enrolled 711/848 mother–baby pairs randomly assigned to 1 of 3 study arms as per the Consolidated Standards of Reporting Trials (CONSORT) flow diagram Fig. 1 (233, 241, and 237 in groups A, B, and C, respectively). A total of 137 (16.1% of screened) mother–child pairs were excluded: 8 women (5.8% of excluded) were underage, 42 (30.6%) refused to participate, and 87 (63.5%) were unwell on the day of screening. The overall median age at enrolment was 30 years (IQR: 25–34). Only 17.7% of the women were over 35 years old. About a third (34.5%) of women had completed high school, and 40.3% were employed (Table 1). There were no significant differences in the sociodemographic characteristics of women by randomization arms.

Although 50.1% of the women screened positive for some level of postpartum depression, 56.1% reported high expectations of general social support. Most women (93.6%) received inpregnancy support from the baby's father, but fewer (63.1%) also expected childcare support from the father.

Over half of the women (58.1%) lived in secondary homes, with 50.8% having a primary home in another SA province or another country. Among those with planned postpartum moves, 30.9% changed their primary healthcare clinic for the child HIV PCR, while 17% of those who did not plan to move eventually changed clinics. Overall, 74.7% of children who received a second PCR test were tested at the mother's ANC clinic, and 6.4% accessed care outside Gauteng (Fig. 2). Although all mothers knew about the blood sample taken for the birth HIV PCR, only 22.9% received their baby's birth HIV results during the first postnatal visit at the MOU.

3.1. Completion of the second child HIV PCR test by 6 months

Overall, 526/711 (74.0%) babies were retained in the first 6 months, 174 (74.6%) in the intervention group versus 175 (72.6%) and 177 (74.7%) in control groups B and C, respectively. Overall, 501/711 (70.5%) babies had a second HIV PCR test result by 6 months, 70.8% in the intervention arm (A), 70.5% in group B, and 70.3% in group C (Fig. 3) (Table 2).

Overall, child testing in the first 6 months was higher among older mothers (>35 years) (aRR 1.1, vs mothers 18–25 years old 95% CI: 1.0–1.3) and unemployed mothers who were not job hunting (aRR 1.2 vs employed mothers, 95% CI: 1.0–1.3). Child testing was lower when mothers lived in non-primary homes (aRR 0.9 for the primary home in other SA provinces vs current, 95% CI: 0.9–1.0) and having planned postpartum moves (aRR 0.8, 95% CI: 0.7–1.0). However, among children who were retained at 6 months, PCR testing was higher when clinic changes occurred within Gauteng (aRR 1.2, 95% CI: 1.1–1.3) or elsewhere in SA (aRR 1.3, 95% CI: 1.2–1.4) compared with accessing PCR tests at the site of ANC.

3.2. Completion of the second child HIV PCR test by 90 days

While the overall proportion of babies tested was similar across randomization groups, timely PCR (7–90 days) was highest in the intervention arm (60.9%) compared with group B (48.1%,

Table 1

Characteristics of HIV positive women by randomization attending postpartum care in Gauteng, South Africa.

	MI retention counseling and phone tracing (A)		Standard care with phone tracing (B)		Standard care (C)		Total	
	N = 233	% (95% CI)	N = 241	% (95% CI)	N = 237	% (95% CI)	N = 711	% (95% CI)
Age								
Median, IQR	233	30.0 (25.0–34.0)	241	30.0 (26.0–34.0)	237	30.0 (25.0–34.0)	711	30.0 (25.0–34.0)
18–25	63	27.0 (21.7–33.1)	59	24.5 (19.4–30.3)	63	26.6 (21.3–32.6)	185	26.0 (22.9–29.4)
26–30	66	28.3 (22.9–34.5)	73	30.3 (24.8–36.4)	69	28.7 (23.3–34.8)	207	29.1 (25.9–32.6)
31–35	69	29.6 (24.1–35.8)	63	26.1 (21.0–32.1)	61	25.7 (20.6–31.7)	193	27.1 (24.0–30.5)
>35	35	15.0 (11.0–20.2)	46	19.1 (14.6–24.6)	45	19.1 (14.6–24.6)	126	17.7 (15.1–20.7)
Time to enrollment, d								
Median, IQR	233	4.0 (2.0–4.0)	241	3.0 (2.0–4.0)	237	4.0 (2.0–4.0)	711	3.0 (2.0–4.0)
Highest level of education								
≤ Grade 7	13	5.6 (3.2–9.4)	20	8.3 (5.4–12.5)	20	8.4 (5.5–12.7)	53	7.5 (5.7–9.6)
Grades 8–11	138	59.2 (52.8–65.3)	130	53.9 (47.6–60.1)	145	61.2 (54.8–67.2)	413	58.1 (54.4–61.7)
Completed Grade 12	53	22.7 (17.8–28.6)	58	24.1 (19.1–29.9)	48	20.2 (15.6–25.9)	159	22.4 (19.4–25.6)
Tertiary education	29	12.4 (8.8–17.4)	33	13.7 (9.9–18.7)	24	10.1 (6.9–14.7)	86	12.1 (9.9–14.7)
Employment								
Employed	99	42.4 (36.3–49.0)	101	41.9 (35.8–48.3)	86	36.4 (30.5–42.8)	286	40.3 (36.7–43.9)
Unemployed (job hunting)	99	42.5 (36.3–49.0)	108	44.8 (38.6–51.2)	118	50.0 (43.6–56.4)	325	45.8 (42.1–49.5)
Unemployed (not job hunting)	35	15.0 (11.0–20.2)	32	13.3 (9.5–18.2)	32	13.6 (9.7–18.6)	99	14.0 (11.6–16.7)
Primary source of income								
Paid job or business	72	31.9 (26.1–38.2)	74	31.8 (26.1–38.0)	61	26.6 (21.3–32.8)	207	30.1 (26.8–33.6)
Government grant	22	9.7 (6.5–14.4)	15	6.4 (3.9–10.4)	17	7.4 (4.7–11.6)	54	7.8 (6.1–10.1)
Spouse/partner	115	50.9 (44.4–57.4)	124	53.2 (46.8–59.6)	129	56.3 (49.8–62.6)	368	53.5 (49.7–57.2)
Parents/relatives	17	7.5 (4.7–11.8)	20	8.6 (5.6–13.0)	22	9.6 (6.4–14.2)	59	8.6 (6.7–10.9)
Missing	72	31.9 (26.1–38.2)	74	31.8 (26.1–38.0)	61	26.6 (21.3–32.8)	207	30.1 (26.8–33.6)
Marital status								
Not in a relationship	44	18.9 (14.3–24.4)	36	14.9 (11.0–20.0)	43	18.1 (13.7–23.6)	123	17.3 (14.7–20.2)
In a relationship	181	77.7 (71.9–82.6)	193	80.1 (74.5–84.7)	182	76.8 (71.0–81.7)	556	78.2 (75.0–81.1)
Married	8	3.4 (1.7–6.7)	12	5.0 (2.8–8.6)	12	5.1 (2.9–8.7)	32	4.5 (3.2-6.3)
Participant lives with								
Alone/ main adult with children	21	9.0 (5.9–13.4)	14	5.8 (3.5–9.6)	16	6.8 (4.2–10.8)	51	7.1 (5.5–9.3)
With partner/spouse	145	62.2 (55.8–68.2)	147	61.0 (54.7–67.0)	159	67.1 (60.8–72.8)	451	63.4 (59.8–66.9)
Parents/relatives	67	28.8 (23.3–35.0)	80	33.2 (27.5–39.4)	62	26.2 (20.9–32.2)	209	29.4 (26.2–32.9)
Location of primary house								
Current house	97	42.7 (36.4–49.3)	104	44.6 (38.4–51.1)	88	38.3 (32.2–44.7)	289	41.9 (38.2–45.6)
Same province	12	5.3 (3.0–9.1)	17	7.3 (4.6–11.4)	21	9.1 (6.0–13.6)	50	7.2 (5.5–9.4)
Another province/rural area	78	34.4 (28.5–40.8)	59	25.3 (20.1–31.3)	71	30.9 (25.2–37.2)	208	30.1 (26.8–33.7)
Another country	40	17.6 (13.2–23.2)	53	22.7 (17.8–28.6)	50	21.7 (16.9–27.6)	143	20.7 (17.9–23.9)
Planned postpartum mobility								
No	205	87.9 (83.1–91.6)	221	91.7 (87.5–94.6)	213	90.3 (85.7–93.4)	639	90.0 (87.6–92.0)
Yes	28	12.0 (8.4–16.9)	20	8.3 (5.4–12.5)	23	9.7 (6.6–14.3)	71	10.0 (8.0–12.4)
HIV knowledge								
Low/medium	17	7.3 (4.6–11.5)	21	8.7 (5.7–13.0)	24	10.2 (6.9–14.7)	62	8.7 (6.9–11.0)
High	216	92.7 (88.5–95.4)	220	91.3 (87.0–94.3)	213	89.9 (85.3–93.1)	649	91.3 (89.0–93.2)
Number of older children								
None	49	21.0 (16.3–26.8)	38	15.8 (11.7–20.9)	36	15.3 (11.2–20.4)	123	17.3 (14.7–20.3)
1–2 children	153	65.7 (59.3–71.5)	174	72.2 (66.2–77.5)	161	68.2 (62.0–73.9)	488	68.7 (65.2–72.0)
>2 children	31	13.3 (9.5–18.3)	29	12.0 (8.4–16.8)	39	16.5 (12.3–21.8)	99	13.9 (11.6–16.7)
Birth HIV PCR results received								
Yes	58	24.9 (19.7–30.9)	50	20.8 (16.1–26.4)	55	23.2 (18.2–29.1)	163	22.9 (20.0–26.2)
No	175	75.1 (69.1–80.3)	191	79.3 (73.6–83.9)	182	76.8 (70.9–81.7)	548	77.1 (73.8–80.0)
Latest pregnancy planned								
No	128	54.9 (48.5–61.2)	123	51.0 (44.7–57.3)	138	58.5 (52.1–64.6)	389	54.8 (51.1–58.4)
Yes	105	45.1 (38.7–51.5)	118	48.9 (42.7–55.3)	98	41.5 (35.4–47.9)	321	45.2 (41.6–48.9)
ANC attendance								
No	5	2.1 (0.8–5.1)	4	1.7 (0.6–4.3)	2	0.8 (0.2–3.3)	11	1.5 (0.9–2.8)
Yes	228	97.9 (94.9–99.1)	237	98.3 (95.6–99.3)	234	99.2 (96.7–99.8)	699	98.5 (97.2–99.1)
Province of antenatal care (ANC)								
ANC out of Gauteng	7	3.1 (1.5–6.4)	2	2.6 (1.2–5.7)	6	1.7 (0.6–4.5)	15	2.4 (1.5–3.9)
ANC in Gauteng	220	96.9 (93.6–98.5)	235	97.4 (94.3–98.8)	228	98.3 (95.5–99.4)	684	97.5 (96.1–98.5)
ANC and postpartum care facility (including 10-weeks PCR test)								

(*continued*)

Table 1
(continued).

	MI retention counseling and phone tracing (A)		Standard care with phone tracing (B)		Standard care (C)		Total	
	N = 233	% (95% CI)	N = 241	% (95% CI)	N = 237	% (95% CI)	N = 711	% (95% CI)
Same as ANC PHC	176	75.5 (69.6–80.7)	162	67.2 (61.0–72.9)	147	62.0 (55.6–68)	485	68.2 (64.7–71.5)
Changed PHC in Gauteng	18	7.7 (4.9–12.0)	22	9.1 (6.1–13.5)	35	14.8 (10.8–19.9)	75	10.5 (8.5–13.0)
Inter-province PHC change	11	4.7 (2.6–8.4)	11	4.6 (2.5–8.1)	12	5.1 (2.9–8.7)	34	4.8 (3.4–6.6)
Missing ANC or postpartum care attendance	28	12.0 (8.4–16.9)	46	19.1 (14.6–24.6)	43	18.1 (13.7–23.6)	117	16.5 (13.9–19.4)
Gender of baby								
Male	111	47.6 (41.2–54.1)	120	49.8 (43.5–56.1)	128	54.0 (47.6–60.3)	359	50.5 (46.8–54.2)
Female	122	52.4 (45.9–58.7)	121	50.2 (43.9–56.5)	109	46.0 (39.7–52.4)	352	49.5 (45.8–53.2)
Father's involvement during pregnancy								
Involved	223	95.7 (92.2–97.7)	220	91.3 (87.0–94.3)	220	93.2 (89.2–95.8)	663	93.4 (91.3–95.0)
Not involved	10	4.3 (2.3–7.8)	21	8.7 (5.7–13.0)	16	6.8 (4.2–10.8)	47	6.6 (5.0–8.7)
Main supporter during pregnancy								
Partner	126	54.1 (47.6–60.4)	126	52.3 (45.9–58.5)	138	58.5 (52.1–64.6)	390	54.9 (51.2–58.6)
Baby father (if not partner)	56	24.0 (19.0–30.0)	59	24.5 (19.4–30.3)	59	25.0 (19.9–30.9)	174	24.5 (21.5–27.8)
Family members	51	21.9 (17.0–27.7)	56	23.2 (18.3–29.0)	39	16.5 (12.3–21.8)	146	20.6 (17.7–23.7)
Expected main childcare supporter								
Partner	92	40.4 (34.2–46.9)	96	41.2 (35.0–47.7)	98	42.6 (36.3–49.1)	286	41.4 (37.8–45.1)
Baby father (if not partner)	52	22.8 (17.8–28.7)	52	22.3 (17.4–28.1)	58	25.2 (20.0–31.3)	162	23.4 (20.4–26.8
Family members	84	36.8 (30.8–43.3)	85	36.5 (30.5–42.9)	74	32.2 (26.4–38.5)	243	35.1 (31.7–38.8)
Perceived social support (PSS)								
High PSS	126	54.1 (47.6–60.3)	137	56.9 (50.5–63.0)	135	57.2 (50.8–63.3)	398	56.1 (52.3–59.7)
Medium PSS	107	45.9 (39.6–52.4)	104	43.2 (37.0–49.5)	101	42.8 (36.6–49.2)	312	43.9 (40.3–47.6)
Postpartum depression (PPD)								
Not depressed	110	48.3 (41.8–54.8)	116	49.8 (43.8–56.6)	119	51.5 (45.1–57.9)	345	49.9 (46.1–53.6)
Any depression	118	51.7 (45.2–58.2)	117	50.2 (43.8–56.6)	112	48.5 (42.1–54.9)	347	50.1 (46.4–53.9)

CI = confidence intervals, HIV = human immunodeficiency virus, IQR = interquartile range, MI = motivational interviewing, PCR = polymerase chain reaction.

aRR 0.8 B vs A, 95% CI: 0.7–0.9) and group C (52.7%, aRR 0.9 C vs A, 95% CI: 0.7–1.0) (Table 2).

The likelihood of a timely child HIV PCR test was higher when mothers were older (aRR 1.2 for 31–35 vs 18–25years old, 95% CI: 1.0–1.4) and clinic changes occurred within Gauteng (aRR 1.2 vs no clinic change, 95% CI: 1.0–1.4). However, child testing was delayed when mothers lived with a partner/spouse (aRR 0.8 vs being the only household adult, 95% CI: 0.7–0.9) or with

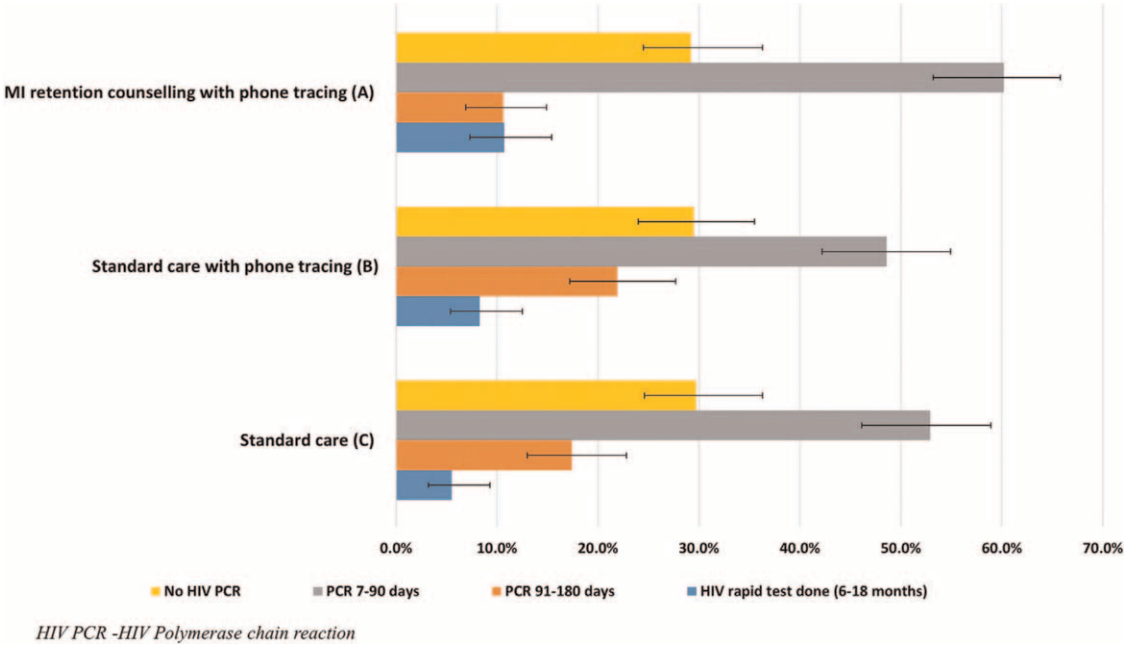

Figure 3. Uptake and timing of the second infant HIV PCR and 7 to 18months HIV antibody test among HIV-exposed children by randomization group. HIV= human immunodeficiency virus, PCR = polymerase chain reaction.

Table 2

Adjusted log binomial regression to assess the timing of the second infant HIV PCR test.

	HIV PCR done (N = 711)			HIV PCR 7–90 days (N = 711)		
	n (%)	RR (95% CI)	aRR (95% CI)	n (%)	RR (95% CI)	aRR (95% CI)
Randomization						
MI counselling and phone tracing (A)	165 (70.8)	1	1	142 (60.9)	1	1
Standard care with phone tracing (B)	170 (70.5)	1.0 (0.9–1.1)	1.1 (0.9–1.2)	116 (48.1)	0.8 (0.7–0.9)	0.8 (0.7–0.9)
Standard care (C)	166 (70.3)	1.0 (0.9–1.1)	1.0 (0.9–1.1)	125 (52.7)	0.9 (0.7–1.0)	0.9 (0.7–1.0)
Age, y						
18–25	118 (63.8)	1	1	86 (46.7)	1	1
26–30	146 (70.5)	1.1 (1.0–1.3)	1.0 (0.9–1.1)	110 (53.4)	1.2 (0.9–1.4)	1.0 (0.8–1.3)
31–35	149 (77.2)	1.2 (1.1–1.4)	1.1 (0.9–1.2)	118 (61.1)	1.3 (1.1–1.6)	1.2 (1.0–1.4)
>35	88 (69.8)	1.1 (0.9–1.3)	1.1 (1.0–1.3)	69 (54.8)	1.2 (0.9–1.5)	1.1 (0.9–1.4)
Highest level of education						
High school or less	323 (69.3)	1		247 (53.1)	1	
Matric	117 (73.6)	1.1 (0.9–1.2)		85 (53.5)	1.0 (0.9–1.2)	
Tertiary level	61 (70.9)	1.0 (0.9–1.2)		51 (59.3)	1.1 (0.9–1.4)	
Employment						
Employed	197 (68.9)	1	1	148 (51.7)	1	
Unemployed (not job hunting)	80 (80.8)	1.2 (1.0–1.3)	1.2 (1.0–1.3)	57 (57.6)	1.1 (0.9–1.4)	
Unemployed (job hunting)	224 (68.9)	1.0 (0.9–1.1)	1.0 (0.9–1.1)	178 (54.8)	1.1 (0.9–1.2)	
Primary source of income						
Paid job, salary or business	151 (72.9)	1		117 (56.5)	1	
Spouse/partner	266 (72.3)	1.0 (0.9–1.1)		204 (55.4)	1.0 (0.8–1.1)	
Parents/relatives/government grant	80 (70.8)	1.0 (0.8–1.1)		59 (52.7)	0.9 (0.7–1.2)	
Marital status						
Married	97 (78.9)	1	1	71 (57.7)	1	
In a relationship	381 (68.5)	0.9 (0.8–1.0)	1.0 (0.9–1.1)	294 (52.9)	0.9 (0.8–1.1)	
Not in a relationship	23 (74.2)	0.9 (0.7–1.2)	0.9 (0.7–1.1)	18 (58.1)	1.0 (0.7–1.4)	
Participant lives with						
Alone/only adult with children	39 (76.5)	1		240 (53.3)	1	1
With partner/spouse	320 (71.0)	0.9 (0.8–1.1)		108 (51.7)	0.8 (0.6–0.9)	0.8 (0.7–0.9)
Parents/relatives	142 (67.9)	0.9 (0.7–1.1)		35 (68.6)	0.7 (0.6–0.9)	0.9 (0.7–1.0)
Location of primary house						
Current house	215 (74.4)	1	1	161 (55.7)	1	
Somewhere in Gauteng	39 (78.0)	1.0 (0.9–1.2)	1.1 (0.9–1.2)	31 (62)	1.1 (0.9–1.4)	
Another SA province	146 (70.5)	0.9 (0.8–1.1)	0.9 (0.9–1.0)	111 (53.6)	1.0 (0.8–1.1)	
Another country	98 (68.5)	0.9 (0.8–1.0)	0.9 (0.8–1.0)	78 (54.5)	1.0 (0.8–1.2)	
Planned postpartum mobility						
No	458 (71.7)	1	1	351 (54.9)	1	
Yes	43 (60.6)	0.8 (0.7–1.0)	0.8 (0.7–1.0)	32 (45.1)	0.8 (0.6–1.1)	
HIV knowledge						
Low/medium	39 (62.9)	1		27 (43.5)	1	
High	462 (71.3)	1.1 (0.9–1.4)		356 (54.9)	1.3 (0.9–1.7)	
Birth HIV PCR results received						
Yes	387 (70.8)	1		302 (55.1)	1	
No	114 (69.9)	1.0 (0.9–1.1)		81 (49.7)	0.9 (0.8–1.1)	
Number of older children						
0 children	74 (60.2)	1	1	55 (44.7)	1	1
1–2 children	353 (72.3)	1.2 (1.0–1.4)	1.0 (0.9–1.2)	273 (55.9)	1.3 (1.0–1.5)	1.0 (0.2–1.3)
≥2 children	74 (74.8)	1.2 (1.0–1.5)	1.0 (0.8–1.1)	55 (55.6)	1.2 (1.0–1.6)	1.0 (0.7–1.3)
Latest pregnancy planned						
No	278 (71.5)	1		216 (55.5)	1	
Yes	223 (69.5)	1.0 (0.9–1.0)		167 (52)	0.9 (0.8–1.1)	
ANC and postpartum care facility (including 10-weeks PCR test)						
Same as ANC PHC	389 (80.4)	1	1	301 (62.1)	1	1
Changed PHC in Gauteng	71 (94.7)	1.2 (1.1–1.3)	1.2 (1.1–1.3)	55 (73.3)	1.2 (1.0–1.4)	1.2 (1.0–1.4)
Inter-province PHC change	33 (97.1)	1.2 (1.1–1.3)	1.3 (1.2–1.4)	21 (61.8)	1.0 (0.8–1.3)	1.0 (0.8–1.3)
Missing ANC or postpartum care attendance	8 (6.8)	0.1 (0.04–0.2)	0.1 (0.1–0.2)	6 (5.1)	0.1 (0.04–0.2)	0.1 (0.04–0.2)
Baby's father's involvement during pregnancy						
Involved	469 (70.7)	1		358 (54)	1	
Not involved	32 (68.1)	1.0 (0.8–1.2)		25 (55.6)	1.0 (0.8–1.3)	
Perceived primary in-pregnancy supporter						
Partner	281 (72.1)	1		202 (51.8)	1	

(*continued*)

Table 2

(continued).

	HIV PCR done (N = 711)			HIV PCR 7–90 days (N = 711)		
	n (%)	RR (95% CI)	aRR (95% CI)	n (%)	RR (95% CI)	aRR (95% CI)
Baby's father (if not partner)	118 (67.8)	0.9 (0.8–1.1)		98 (56.3)	1.1 (0.9–1.3)	
Family members	102 (69.9)	1.0 (0.9–1.1)		83 (57.2)	1.1 (0.9–1.3)	
Expected primary childcare supporter						
Partner	211 (73.8)	1		157 (54.9)	1	
Baby's father (if not partner)	116 (71.6)	1.0 (0.9–1.1)		95 (58.6)	1.1 (0.9–1.3)	
Family members	173 (71.2)	1.0 (0.9–1.1)		131 (53.9)	1.0 (0.8–1.1)	
Perceived social support						
High PSS	279 (70.1)	1		215 (54)	1	
Medium PSS	222 (71.2)	1.0 (0.9–1.1)		168 (53.8)	1.0 (0.9–1.1)	
Postpartum depression						
No depression	259 (75.1)	1	1	305 (57.5)	1	1
Any depression	241 (69.5)	0.9 (0.8–1.0)	1.0 (0.9–1.0)	78 (48.1)	0.8 (0.7–0.9)	0.8 (0.7–1.0)

ANC = antenatal care, CI = confidence intervals, HIV = human immunodeficiency virus, IQR = interquartile range, MI = motivational interviewing, PCR = polymerase chain reaction.

parents/relatives (aRR 0.9 vs being the only household adult, 95% CI: 0.7–1.0). Furthermore, women who had any level of postpartum depression delayed the second child PCR test (aRR 0.8, 95% CI: 0.7–1.0).

In a model restricted to children who accessed PCR tests, receiving a timely HIV PCR test was also lower when mothers were unaware of the babies' birth HIV status (aRR 0.9, 95% CI: 0.8–1.0) and higher when mothers perceived high in-pregnancy support from the baby's father (not a partner) (aRR 1.2 vs a sexual partner, 95% CI: 1.0–1.4) or family members (aRR 1.1 vs a sexual partner, 95% CI: 1.0–1.3).

3.3. Uptake of the child HIV test (rapid/ PCR) in the 7 to 18-month period

Overall, 47.7% of children were retained (in care) at 7 to 18 months, slightly more in the intervention group (53.2%, 95% CI: 46.6–59.8) compared with 46.5% (95% CI: 40.0–53.0) and 43.4% (95% CI: 37.1–50.0) in groups B and C, respectively. However, only 58/711 (8.2%) of babies (17.1% of those retained) had an HIV test result at 7 to 18 months. A higher proportion of babies in the intervention group (10.7%) were tested compared with 8.3% in group B (RR 0.8, 95% CI: 0.4–1.4) and 5.5% in group C (RR 0.5, 95% CI: 0.3–1.0) with a final 18-months vertical transmission rate of 0.7%.

3.4. Maternal retention (clinic attendance for their health) and viral suppression

Overall maternal retention (41.6%) in the first 6 postpartum months was a little higher in the intervention (A) group compared with control groups B (RR 0.9, 95% CI: 0.7–1.0) and C (0.9, 95% CI: 0.7–1.0). Retention was much lower in the 7 to 18-month period at 24.2%. Overall, 25.7% of retained (1–6 months) mothers had no viral load measurements. Group C women had a higher missing viral load measurement (32.3%, RR 1.6 for group C vs A, 95% CI: 1.0–2.7) followed by group B (28.4%, RR 1.8 for group C vs A, 95% CI: 1.1–3.0) and then the intervention group (17.6%) (Tables 3 and 4).

Overall, 146 (20.5%) women were virally suppressed at 6 months (49.3% of those retained). Six-month viral suppression was not significantly higher in group A (24.5%) compared with 19.1% for group B (RR 0.8 vs A, 95% CI: 0.6–1.1) and 18.1% for group C (RR 0.7 vs A, 95% CI: 0.5–1.1).

In the multivariate log-binomial model for maternal retention in the first 6 months, there was no difference between the intervention group and the controls. Predictors of maternal retention were receiving financial support from the family (aRR 1.2 vs a sexual partner, 95% CI: 1.0–1.6), living in a temporary home (aRR 1.3 primary home in other SA province vs current, 95% CI: 1.1–1.5), having planned postpartum moves (RR 1.4, 95% CI: 1.1–1.7) and medium perceived social support (aRR 1.4 vs high social support, 95% CI: 1.1–1.9). Similarly, postpartum depression increased the likelihood of 6-month retention (aRR 1.4, 95% CI: 1.1–1.9).

4. Discussion

We sought to determine the effect of a brief MI counseling intervention on the retention of HIV positive postpartum women and their adherence to the early infant HIV diagnostic testing schedule. To the best of our knowledge, this is also one of the first

Table 3

Maternal retention and viral suppression during the 1–6 and 7–18 months postpartum periods.

Study group	Period 1–6 months postpartum				Period 7–18 months postpartum			
	Maternal retention/total		Viral suppression/total		Maternal retention/total		Viral suppression/total	
	n (%)	RR (95% CI)	n (%)	RR (95% CI)	n (%)	RR (95% CI)	n (%)	RR (95% CI)
A	108 (46.4)	1	57 (24.5)	1	50 (21.5)	1	46 (19.7)	1
B	95 (39.4)	0.9 (0.7–1.0)	46 (19.1)	0.8 (0.6–1.1)	66 (27.4)	1.3 (0.9–1.8)	57 (23.7)	1.2 (0.8–1.7)
C	93 (39.2)	0.9 (0.7–1.0)	43 (18.1)	0.7 (0.5–1.1)	56 (23.6)	1.1 (0.8–1.5)	8 (20.3)	1.0 (0.7–1.5)

CI = confidence intervals, RR = risk ratio.

Table 4

Predictors of maternal retention during the 1–6 months postpartum periods.

	Maternal retention by 6 months postpartum (N = 711)		
	n (%)	RR (95% CI)	aRR (95% CI)
Randomization			
MI retention counselling and phone tracing (A)	108 (46.4)	1	
Standard care with phone tracing (B)	95 (39.4)	0.9 (0.7–1.0)	0.9 (0.7–1.1)
Standard care (C)	93 (39.2)	0.8 (0.7–1.0)	0.9 (0.7–1.1)
Age			
18–25	77 (41.6)	1	
26–30	87 (42.2)	1.0 (0.8–1.3)	
31–35	82 (42.5)	1.0 (0.8–1.3)	
>35	50 (39.7)	1.0 (0.7–1.3)	
Highest level of education			
High school or less	188 (40.4)		
Matric	66 (41.5)	1.0 (0.8–1.3)	
Tertiary level	42 (48.8)	1.2 (0.9–1.5)	
Employment			
Employed	119 (41.6)	1	
Unemployed (not job hunting)	44 (44.4)	1.1 (0.8–1.4)	
Unemployed (job hunting)	133 (40.9)	1.0 (0.8–1.2)	
Primary source of income			
Paid job, salary or business	89 (43.0)	1	1
Spouse/partner	140 (38.0)	0.9 (0.7–1.1)	0.9 (0.7–1.1)
Parents/relatives/government grant	59 (52.7)	1.2 (1.0–1.6)	1.2 (1.0–1.6)
Marital status			
Married	44 (35.8)	1	
In a relationship	238 (42.8)	1.2 (0.9–1.5)	
Not in a relationship	14 (45.2)	1.3 (0.8–2.0)	
Participant lives with			
Alone/only adult with children	180 (40.0)	1	
With partner/spouse	98 (46.9)	1.1 (0.8–1.7)	
Parents/relatives	18 (35.3)	1.3 (0.9–2.0)	
Location of primary house			
Current house	116 (40.1)	1	1
Somewhere in Gauteng	20 (40.0)	1.0 (0.7–1.4)	1.0 (0.7–1.5)
Another SA province	99 (47.8)	1.2 (1.0–1.5)	1.3 (1.1–1.5)
Another country	55 (38.5)	1.0 (0.7–1.2)	1.0 (0.8–1.3)
Planned postpartum mobility			
No	257 (40.2)	1	
Yes	39 (54.9)	1.4 (1.1–1.7)	
HIV knowledge			
Low	84 (39.6)	1	
Medium to high	205 (43.2)	1.0 (0.9–1.1)	
Birth HIV PCR results received			
Yes	232 (42.3)	1	
No	64 (39.3)	0.9 (0.7–1.1)	
Number of older children			
0 children	56 (45.5)	1	
1–2 children	206 (42.2)	0.9 (0.7–1.2)	
≥2 children	34 (34.3)	0.8 (0.5–1.1)	
Latest pregnancy planned			
No	164 (42.2)	1	
Yes	132 (41.1)	1.0 (0.8–1.2)	
ANC and postpartum care facility (including 10-weeks PCR test)			
Same as ANC PHC	216 (44.5)	1	
Changed PHC in Gauteng	37 (49.3)	1.1 (0.9–1.4)	
Inter-province PHC change	14 (41.2)	0.9 (0.6–1.4)	
Missing ANC or postpartum care attendance	29 (24.8)	0.6 (0.4–0.8)	
Baby's father's involvement during pregnancy			
Involved	276 (41.6)	1	
Not involved	20 (44.4)	1.1 (0.8–1.5)	
Perceived primary in-pregnancy supporter			
Partner	152 (39.0)	1	

(*continued*)

Table 4
(continued).

	Maternal retention by 6 months postpartum (N = 711)		
	n (%)	RR (95% CI)	aRR (95% CI)
Baby father (if not partner)	75 (43.1)	1.1 (0.9–1.4)	1.3 (0.9–2.2)
Family members	69 (47.6)	1.2 (1.0–1.5)	1.2 (0.9–1.6)
Expected primary childcare supporter			
Partner	111 (38.8)	1	
Baby father (if not partner)	68 (42.0)	1.1 (0.9–1.4)	0.8 (0.5–1.2)
Family members	112 (46.1)	1.2 (1.0–1.4)	1.0 (0.7–1.3)
Perceived social support (PSS)			
High PSS	146 (36.7)	1	
Medium PSS	150 (48.1)	1.3 (1.1–1.6)	1.4 (1.1–1.9)
Postpartum depression (PPD)			
No depression	121 (35.1)	1	
Any depression	170 (49.1)	1.4 (1.2–1.7)	1.4 (1.1–1.9)

CI = confidence intervals, HIV = human immunodeficiency virus, IQR = interquartile range, MI = motivational interviewing, PCR = polymerase chain reaction, RR = risk ratio.

studies to accurately determine the second child HIV PCR test uptake in a cohort of HIV exposed infants in the Gauteng province of South Africa. HIV exposed children who receive two HIV PCR tests have higher survival, especially when at least 75% receive both tests, and the results are returned to the parent.[25–27]

4.1. Intervention effect on child HIV testing and maternal retention

Postpartum MI retention counseling did not affect the overall maternal retention or improve the overall uptake of the second child HIV PCR test, which was estimated at 70.1%. However, children in the intervention group received the second HIV PCR test earlier than the control groups. Furthermore, the intervention group had higher uptake of the child HIV test in the 7 to 18-month age period than both control groups. The low testing at 18-months may reflect insufficient data on children's rapid tests but suggests that a vast majority of HIV exposed infants do not complete the later HIV tests and possibly remain undiagnosed until later in life. While the intervention showed little effect on maternal postpartum retention, retained women in the intervention group were more likely to have received a viral load test in the first 6 postpartum months than the controls.

The lower maternal retention at 6 months compared with child retention and HIV PCR test uptake (74.0%) is consistent with previously reported declines in women's need to protect children from HIV acquisition after pregnancy.[17,29–34] Maternal retention in our study was also much lower compared with a similar population in the Western Cape Province,[32,35] probably associated with data management differences between the Gauteng and the Western Cape provincial health care systems. The followup HIV PCR estimate is similar to the 67.4% reported in the same period in the Western Cape province.[35] However, a cohort study in the Free state province reported a 36.7% follow-up PCR uptake after birth,[28] highlighting missed opportunities to maximize maternal retention and the need for more data to identify regions that need strengthening to close the child testing gap.

4.2. Predictors of timely adherence to child HIV PCR testing and maternal retention by 6 months

While previous studies found that a birth HIV PCR result could reduce the adherence to follow-up tests, we found that non receipt of the birth HIV PCR result resulted in delayed uptake of the second HIV PCR test.[35] The value of this first PCR test is reduced if mothers leave obstetric care without the baby's birth HIV results, as child tracing is often complicated by postpartum migration and inaccurate contact information.[2,6,17,36]

While living in temporary homes and postpartum migration can create linkage challenges for both mother and child, our results suggest that participants who moved accessed HIV PCR testing more timeously. Pre-planned postpartum mobility may be accompanied by pre-planned clinic attendance and better access to alternative child caregivers than unplanned migration.[33]

We found that women who were not job hunting had higher child HIV PCR uptake than employed women. The absence of paid leave benefits possibly limits access to child PCR tests, but employed women may also have the means to seek private healthcare for their children and therefore appear lost from the public health sector.[37,38]

Similar to previous reports, high in-pregnancy social support was associated with high follow-up HIV PCR uptake.[39] Also, timely HIV PCR tests were higher when mothers had high decision-making power (primary household adult/older) than when decision-making was shared with a partner/family member.[17,31,40,41]

Maternal postpartum depression was associated with higher maternal retention but lower PCR uptake. These findings on depression contrast the results of previous studies[34,42,43] and require further investigation.

4.3. Limitations

While the results of this study are encouraging, they are specific to the Gauteng province and settings from which participants were drawn. Additionally, retention estimates may be underestimated because although the determination of patient retention included a national search of laboratory results, the clinic visit record review was limited to the Gauteng province. Also, patient management data in South Africa is not networked, and searches for clinic visit records were informed by patient interviews and did not capture unplanned clinic changes. Finally, data capturing of rapid HIV tests for both adults and children is generally poor, resulting in underestimated uptake of child testing in the 7 to 18 months period.

5. Conclusions

MI retention counseling provided early in the postpartum period resulted in some improvement in the timing of the second child HIV PCR and the adherence to the exit antibody test but had no impact on maternal retention in care. The estimated 70% follow-up HIV PCR of HIV exposed infants is encouraging, considering the postpartum trajectories of HIV positive mothers and their children. However, almost 30% of postpartum women who returned to the clinic lacked viral load tests demonstrating room for improved postpartum maternal care. The results also highlight the critical need to ensure that mothers receive the birth results of their babies at the postnatal visit to improve child testing.

Acknowledgments

The authors are grateful to all study participants for their contribution to this research, health facilities for accommodating our data collection team, and the National Health Services Laboratories for facilitating the patient searches on the laboratory test database. Additionally, they would like to acknowledge their counseling and data collection team's commitment and tireless efforts: Annah Morifi, Hazel Tau, Zanele Walaza, Thato Mokobocho, Martha Mothibi, and Sekai Chiwaye.

Author contributions

Conceptualization: Dorina Onoya, Gayle Sherman.
Formal analysis: Cornelius Nattey.
Funding acquisition: Dorina Onoya.
Investigation: Dorina Onoya, Constance Mongwenyana, Sithabile Mngadi, William B. MacLeod, Gayle Sherman.
Methodology: Dorina Onoya, William B. MacLeod, Gayle Sherman.
Project administration: Nelly Jinga, Constance Mongwenyana, Sithabile Mngadi.
Supervision: Dorina Onoya.
Writing – original draft: Dorina Onoya, Nelly Jinga.
Writing – review & editing: Dorina Onoya, Cornelius Nattey, Constance Mongwenyana, Sithabile Mngadi, William B. MacLeod, Gayle Sherman.

References

[1] Hanrahan BA, Williams A. Prevention of mother-to-child transmission of HIV guidelines: nurses' views at four primary healthcare facilities in the Limpopo Province. South Afr J HIV Med 2017;18:690.
[2] Goga A, Chirinda W, Ngandu N, et al. Closing the gaps to eliminate mother-to-child transmission of HIV (MTCT) in South Africa: understanding MTCT case rates, factors that hinder the monitoring and attainment of targets, and potential game-changers. South Afr Med J 2018;108:17.
[3] South African National AIDS Council. National Strategic Plan on HIV, TB and STIs 2017–2022. Pretoria; 2017.
[4] South African National Department of Health (SA-NDoH). National Consolidated Guidelines for the Prevention of Mother-to-Child Transmission of HIV (PMTCT) and the Management of HIV in Children, Adolescents and Adults. Pretoria; 2015.
[5] Massyn NBP, Day C, Ndlovu N, Padarath A. District Health Barometer 2018/2019. Durban; 2020.
[6] Ahmed S, Kim MH, Sugandhi N, et al. Beyond early infant diagnosis: case-finding strategies for identification of HIV-infected infants and children. AIDS 2013;27(suppl):S235–45.
[7] Iyun V, Technau K-G, Eley B, et al. Earlier antiretroviral therapy initiation and decreasing mortality among hiv-infected infants initiating antiretroviral therapy within 3 months of age in South Africa, 2006–2017. Pediatr Infect Dis J 2020;39:127–33.
[8] Davies M-A. Research gaps in neonatal HIV-related care. South Afr J HIV Med 2015;16:375.
[9] Ferguson L, Grant AD, Watson-Jones D, Kahawita T, Ong'ech JO, Ross DA. Linking women who test HIV-positive in pregnancy-related services to long-term HIV care and treatment services: a systematic review. Trop Med Int Health 2012;17:564–80.
[10] Mathivha E, Olorunju S, Jackson D, Dinh T-H, du Plessis N, Goga A. Uptake of care and treatment amongst a national cohort of HIV positive infants diagnosed at primary care level, South Africa. BMC Infect Dis 2019;19(suppl):790.
[11] Moyo F, Haeri Mazanderani A, Barron P, et al. Introduction of routine HIV birth testing in the South African National consolidated guidelines. Pediatr Infect Dis J 2018;37:559–63.
[12] SA-NDoH. Guideline for the Prevention of Mother to Child Transmission of Communicable Infections. Pretoria; 2019.
[13] Sherman GG. HIV testing during the neonatal period. Southern Afr J HIV Med 2015;16:362.
[14] Lilian RR, Johnson LF, Moolla H, Sherman GG. A mathematical model evaluating the timing of early diagnostic testing in HIV-exposed infants in South Africa. J Acquir Immune Defic Syndr 2014;67:341–8.
[15] Celletti F, Sherman G, Mazanderani AH. Early infant diagnosis of HIV: a review of current and innovative practices. Curr Opin HIV AIDS 2017;12:112–6.
[16] Momplaisir FM, Storm DS, Nkwihoreze H, Jayeola O, Jemmott JB. Improving postpartum retention in care for women living with HIV in the United States. AIDS 2018;32:133–42.
[17] Knettel BA, Cichowitz C, Ngocho JS, et al. Retention in HIV care during pregnancy and the postpartum period in the option B+ era: systematic review and meta-analysis of studies in Africa. J Acquir Immune Defic Syndr 2018;77:427–38.
[18] Koh-Knox CP. Motivational interviewing in health care: helping patients change behavior. Am J Pharm Educ 2009;73:127.
[19] Kiene SM, Bateganya MH, Lule H, Wanyenze RK. The effect of motivational interviewing-based counseling during outpatient provider initiated HIV testing on high-risk sexual behavior in rural uganda. AIDS Behav 2016;20:1928–36.
[20] De Vasconcelos S, Toskin I, Cooper B, et al. Behaviour change techniques in brief interventions to prevent HIV, STI and unintended pregnancies: a systematic review. PLoS One 2018;13:e0204088.
[21] Chang SJ, Choi S, Kim S-A, Song M. Intervention strategies based on information-motivation-behavioral skills model for health behavior change: a systematic review. Asian Nurs Res 2014;8:172–81.
[22] Burke BL, Arkowitz H, Menchola M. The efficacy of motivational interviewing: a meta-analysis of controlled clinical trials. J Consult Clin Psychol 2003;71:843–61.
[23] Suresh K. An overview of randomisation techniques: an unbiased assessment of outcome in clinical research. J Hum Reprod Sci 2011;4:8–11.
[24] Bernstein E, Topp D, Shaw E, et al. A preliminary report of knowledge translation: lessons from taking screening and brief intervention techniques from the research setting into regional systems of care. Acad Emerg Med 2009;16:1225–33.
[25] Chiu A, Modi S, Rivadeneira ED, Koumans EH. Optimising infant HIV diagnosis in resource-limited settings: modeling the impact of HIV DNA PCR testing at birth. J Acquir Immune Defic Syndr 2016;73:454–62.
[26] Francke JA, Penazzato M, Hou T, et al. Clinical impact and costeffectiveness of diagnosing HIV infection during early infancy in South Africa: test timing and frequency. J Infect Dis 2016;214:1319–28.
[27] Kalawan V, Naidoo K, Archary M. Impact of routine birth early infant diagnosis on neonatal HIV treatment cascade in eThekwini district, South Africa. South Afr J HIV Med 2020;21:1084.
[28] Bisschoff C, Coulon J, Isaacs Z, et al. HIV testing at birth: are we getting it right? South Afr J HIV Med 2019;20:951.
[29] Adams JW, Brady KA, Michael YL, Yehia BR, Momplaisir FM. Postpartum engagement in HIV care: an important predictor of longterm retention in care and viral suppression. Clin Infect Dis 2015;61:1880–7.
[30] Malaju MT, Alene GD. Determinant factors of pregnant mothers' knowledge on mother to child transmission of HIV and its prevention in Gondar town, North West Ethiopia. BMC Pregnancy Childbirth 2012;12:73.
[31] Ramjee G, Moonsamy S, Abbai NS, Wand H. Individual and population level impact of key HIV risk factors on HIV incidence rates in Durban. South Africa PLoS One 2016;11:e0153969.

[32] Myer L, Phillips TK, Zerbe A, et al. Integration of postpartum healthcare services for HIV-infected women and their infants in South Africa: a randomised controlled trial. PLoS Med 2018;15: e1002547.
[33] Onoya D, Sineke T, Brennan AT, Long L, Fox MP. Timing of pregnancy, postpartum risk of virologic failure and loss to follow-up among HIV-positive women. AIDS 2017;31:1593–602.
[34] Lytvyn L, Siemieniuk RA, Dilmitis S, et al. Values and preferences of women living with HIV who are pregnant, postpartum or considering pregnancy on choice of antiretroviral therapy during pregnancy. BMJ Open 2017;7:e019023.
[35] Kalk E, Kroon M, Boulle A, et al. Neonatal and infant diagnostic HIV-PCR uptake and associations during three sequential policy periods in Cape Town, South Africa: a longitudinal analysis. J Int AIDS Soc 2018;21:e25212.
[36] Phillips TK, Clouse K, Zerbe A, Orrell C, Abrams EJ, Myer L. Linkage to care, mobility and retention of HIV–positive postpartum women in antiretroviral therapy services in South Africa. J Int AIDS Soc 2018;21 (suppl):e25114.
[37] Jinga N, Mongwenyana C, Moolla A, Malete G, Onoya D. Reasons for late presentation for antenatal care, healthcare providers' perspective. BMC Health Serv Res 2019;19:1016.
[38] UNIC.E.F.Evidence-based Practices for Retention in Care of Mother-Infant Pairs in the Context of Eliminating Mother-to-Child Transmission of HIV in Eastern and Southern Africa: A Summary with Guidance for Scale-up. Geneva;.
[39] Matseke MG, Ruiter RAC, Rodriguez VJ, Peltzer K, Setswe G, Sifunda S. Factors associated with male partner involvement in programs for the prevention of mother-to-child transmission of HIV in rural South Africa. Int J Environ Res Public Health 2017;14:1333.
[40] Ford C, Chibwesha CJ, Winston J, et al. Women's decision-making and uptake of services to prevent mother-to-child HIV transmission in Zambia. AIDS Care 2018;30:426–34.
[41] Technau KG, Kuhn L, Coovadia A, Carmona S, Sherman G. Improving early identification of HIV-infected neonates with birth PCR testing in a large urban hospital in Johannesburg, South Africa: successes and challenges. J Int AIDS Soc 2017;20:21436.
[42] Mokhele I, Nattey C, Jinga N, Mongwenyana C, Fox MP, Onoya D. Prevalence and predictors of postpartum depression by HIV status and timing of HIV diagnosis in Gauteng. South Africa PLoS One 2019;14: e0214849.
[43] Zuniga JA, Yoo-Jeong M, Dai T, Guo Y, Waldrop-Valverde D. The role of depression in retention in care for persons living with HIV. AIDS Patient Care STDS 2016;30:34–8.