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Conditional cash transfers increase uptake of and retention in PMTCT care: A randomized controlled trial

Marcel Yotebieng^{1,2}, Harsha Thirumurthy³, Kathryn E. Moracco⁴, Bienvenu Kawende⁵, Jean Lambert Chalachala⁵, Landry Kipula Wenzu⁵, Noro Lantoniaina Rosa Ravelomanana², Andrew Edmonds², Deidre Thompson², Emile W. Okitolonda⁵, and Frieda Behets^{2,6}

¹The Ohio State University, College of Public Health, Division of Epidemiology, Columbus, OH

²The University of North Carolina at Chapel Hill, Department of Epidemiology, Chapel Hill, NC

³The University of North Carolina at Chapel Hill, Department of Health Policy and Management, Chapel Hill, NC

⁴The University of North Carolina at Chapel Hill, Department of Health Behavior, Chapel Hill, NC

⁵The University of Kinshasa, School of Public Health, Kinshasa, Democratic Republic of Congo

⁶The University of North Carolina at Chapel Hill, Department of Social Medicine, Chapel Hill, NC

Abstract

Background—Novel strategies are needed to increase retention in and uptake of prevention of mother-to-child HIV transmission (PMTCT) services in sub-Saharan Africa.

Objective—To determine whether small, increasing cash payments conditional on attending scheduled clinic visits and receiving proposed services can increase the proportions of HIV-infected pregnant women who accept available PMTCT services and remain in care through six weeks postpartum.

Methods—Newly diagnosed HIV-infected women, 32 weeks pregnant, were recruited at antenatal care clinics in Kinshasa, Democratic Republic of Congo, and assigned in a 1:1 ratio to an intervention or control group using computer-based randomization. The intervention group received compensation on the condition that they attended scheduled clinic visits and accepted offered PMTCT services (\$5, plus \$1 increment at each subsequent visit), while the control group received usual care. Outcomes assessed included: 1) retention in care at six weeks postpartum, and 2) to uptake PMTCT services, measured by attendance of all scheduled clinic visits and acceptance of proposed services through six weeks postpartum. Analyses were intent-to-treat.

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Contributors

MY, HT, FB, KEM, AE, and DT designed the study. MY, EWO, NLRR, BK, JLC, and LW implemented the study and collected data. MY analyzed the data. MY wrote the first draft of the report with input from HT, AE, KEM, FB. All authors contributed to the final report.

CONFLICTS OF INTEREST

The authors declare no conflict of interest

Results—Between April 2013 and August 2014, 612 potential participants were identified, 545 were screened, and 433 were enrolled and randomized. At six weeks post-partum, the proportion of participants retained in care was higher in the intervention group than the control group (174/216, 80·6% vs. 157/217, 72·4%; risk ratio (RR), 1·11; 95% confidence interval (CI), 1·00–1·24). The proportion of participants who attended all clinic visits and accepted proposed services was higher in the intervention group than the control group (146/216, 67·6% vs. 116/217, 53·5%; RR, 1·26; 95% CI, 1·08–1·48). Results were similar after adjusting for marital status, age, and education.

Conclusions—Among newly diagnosed HIV-infected women, small, incremental cash incentives resulted in increased retention along the PMTCT cascade and uptake of available services. The cost-effectiveness of these incentives and their effect on HIV-free survival warrant further investigation.

Keywords

Conditional cash transfers; PMTCT; retention in care; uptake of services; DR Congo; economics

INTRODUCTION

Achieving the President's Emergency Plan for AIDS Relief (PEPFAR) goal of an AIDS-free generation has been reemphasized in PEPFAR 3.0.¹ The current recommendations of lifelong triple antiretroviral therapy (ART) for all HIV-positive pregnant and breastfeeding women regardless of CD4 count (Option B+)² requires that, beginning with the first antenatal care visit, HIV-infected mothers strictly adhere to a continuum of care known as the "prevention of mother-to-child transmission of HIV (PMTCT) cascade".³ The PMTCT cascade includes attendance at regular clinic visits (at a minimum for ART refills), delivery in a health facility, and testing of the HIV-exposed infant (HEI) at six weeks, at nine months, and at the end of all breastfeeding (between 18–24 months). Monitoring data from early implementation of Option B+ in Malawi show that about one in six pregnant women initiated on ART at antenatal care (ANC) registration do not return to the clinic after their initial visit.⁴ A recent meta-analysis of women lost to follow-up (LTFU) across the "PMTCT cascade" indicated that 49% of HIV-infected pregnant women are LTFU between ANC registration and delivery, and 34% of mother-infant pairs are LTFU within three months of delivery.⁵ Half of all new episodes of HIV transmission to children are now estimated to occur during the breastfeeding period when the majority of lactating women are not receiving the prophylaxis necessary to prevent HIV transmission.⁶ Additionally, less than 40% of HEIs are tested for HIV within the first two months of life in priority countries.⁷ Thus, to achieve an AIDS-free generation, novel and effective strategies to reduce LTFU among HIV-infected women and their infants, and to fully maximize adherence to ART, are critically needed.

In resource-limited settings, transportation costs and opportunity costs have been identified as important barriers to PMTCT.¹⁰¹¹ The provision of economic incentives has the potential to help women overcome economic barriers to care-seeking by compensating for transportation costs and opportunity costs of time. In addition, the tendency to place disproportionate weight on immediate costs and discount delayed benefits has been posited

as a reason for suboptimal decision-making in behavioral economics research,^{8,9,12} and may further limit PMTCT behaviors. Economic incentives can address these psychological barriers to health-seeking behavior as well, by creating immediate rewards that “nudge” individuals towards positive health behaviors.¹² Positive behavioral responses to the provision of incentives would also be consistent with the construct of “perceived benefits” that would counter “perceived costs” in the Health Belief Model.¹³ While several recent studies have shown that incentive-based interventions, including conditional cash transfers, can be effective in promoting health behaviors in low- and middle-income countries,^{14–19} no studies have examined whether they can improve PMTCT behaviors and outcomes.

We conducted a randomized controlled trial to determine whether small, increasing cash payments conditional on attending scheduled clinic visits and receiving proposed services can increase the proportions of HIV-infected pregnant women who attend clinic visits and receive available PMTCT services through six weeks postpartum.

METHODS

Study settings and standard of care

The study was conducted in 89 maternal and child health (MCH) facilities in Kinshasa, the capital city of the Democratic Republic of Congo (DRC). Most clinics had been providing PMTCT services for at least two years.

At the time that study enrollment began in 2013, PMTCT services were delivered in the participating clinics through a decentralized model, with pregnant women receiving HIV counseling and testing as well as CD4 testing and results at the MCH clinic. All HIV-infected women were eligible to initiate AZT immediately following receipt of their result. For those with CD4 >350, all subsequent care as well as HIV prevention and care for the HEI (daily NVP, cotrimoxazole, and DNA PCR testing) were delivered at the MCH clinic. For those with CD4 ≤ 350, referrals were made for treatment at the nearest ART center. To ensure linkages between MCH facilities and HIV clinics, HIV-infected trained volunteers counseled and accompanied women diagnosed with HIV. A mother-infant register – modeled after the WHO’s *Three Interlinked Patient Monitoring Systems for HIV Care/ART, MCH/PMTCT (including malaria prevention during pregnancy), and TB/HIV: Standardized Minimum Data Set and Illustrative Tools* – was used to track important HIV care events among HIV-infected pregnant women and subsequently their HEIs, from the first contact with the ANC clinic through 18 months after delivery.²⁰ All HIV-infected women were required to visit the clinic at least once a month to collect their HIV drugs. Those visits were generally timed to match ANC and well-child clinic visits. All study activities were planned during these routine visits. Starting in early 2014, World Health Organization (WHO) Option B+² was progressively implemented in the MCH clinics with ART available onsite.

Participants, randomization, and masking

Between April 2013 and August 2014, newly diagnosed HIV-infected women, 32 weeks pregnant, registering for ANC at one of the 89 clinics during the enrollment period were considered for participation in the study. Potential eligible participants who were severely ill,

did not intend to stay in Kinshasa through at least six weeks postpartum, who refused to participate, or did not speak French or Lingala (the common languages in Kinshasa) were excluded. During their first follow-up visit after ANC registration (generally between two weeks to one month after ANC registration), eligible participants were consented by a study nurse who was not part of the care-providing team. Consented participants were assigned to the intervention or control group in a 1:1 ratio, by use of a computer-generated randomization sequence with varying block sizes of four, six, and eight. To limit heterogeneity of follow-up time, consented women were randomized at the earliest visit between 28 and 32 weeks of gestation. At the randomization visit, after performing all study procedures for the visit including verifying the eligibility of the potential participant, the study staff opened an envelope that contained the participant's group allocation (control or intervention) and a study identification number (PID), and recorded the PID on all study forms including the enrollment questionnaire and the study randomization form used by the cashier to pay out incentives. Envelopes were prepared by a statistician who was not associated with recruitment and follow-up, prior to the beginning of enrollment. Participants who lost their pregnancy before 28 weeks of gestation, failed to return to the clinic after initial diagnosis, or returned after 32 weeks of gestation were also excluded from the study.

The name of each participant and her assigned group were added to the list of participants maintained by a cashier at each facility, for payment purposes. Although it was not possible to conceal the intervention to participants and the study staff, clinical services were provided by clinic staff who were not part of the study team and were not informed of participants' group assignments. Study staff were not involved in clinical care and participants were asked not to communicate their group assignment to clinical staff. Study personnel and clinic staff were trained and supervised to minimize differential treatment by randomization arm, with refresher meetings quarterly.

Intervention – conditional cash transfers

In addition to the standard of care described above, all participants randomized to the intervention group received small, escalating cash payments, starting at US \$5 (US dollars are accepted in DRC) and increasing by \$1 each visit, on the condition that they attended scheduled clinic appointments and completed the following actions (if requested): provide a blood sample for CD4 count and hemoglobin if needed, accept referral for ART if referred, deliver in a health facility, and at 6 weeks postpartum provide a blood sample for early infant HIV diagnosis. The intervention had a reset contingency wherein the escalating value of the incentive went back to its original value (\$5) when the mother failed to complete any of the actions required at a specific visit. The maximum amount of incentive payments that any participant could receive through six months postpartum was \$45. A small card attached to the ANC card was used to track completion of each conditionality for study participants without regard to randomization group. Attending nurses completed the cards and checked the corresponding boxes on the cards to indicate whether or not the conditionalities were completed. Actions that could not be completed for reasons beyond the control of participants (e.g., stock-outs) were checked as completed on the cards. The cards were completed for all participants irrespective of their randomization group. At the end of each

visit, participants took the cards to the cashier, who used them to determine the amount to be paid.

Outcome measures

Two primary outcomes were evaluated: 1) retention in care, defined as the proportion of participants in HIV care at six weeks postpartum without regard to reason of not being in care, and 2) to uptake PMTCT services through six weeks postpartum. Participants were considered to uptake PMTCT services if they met all the conditionalities: attended all their scheduled clinic visits (within five days of the scheduled date) from randomization through six weeks postpartum, including giving birth in a study clinic, and accepted all proposed services including providing blood samples for CD4 count and dried blood spot sample for DNA PCR testing at six weeks. The originally proposed primary outcomes “proportion of women who were adherent to all conditionalities” and “proportion of HIV-exposed infants who at their six week visit received extended NVP and cotrimoxazole and had a DNA PCR test” were refined to take into account constraints that were beyond the control of participants, such as lack of reagents for DNA PCR testing at the national laboratory.

Secondary outcomes assessed were 1) LTFU – the proportion of participants who were not in care at six weeks postpartum and whose whereabouts were unknown (participants who were dead, and participants who did not return to the clinic because they experienced a poor pregnancy outcome but could still be reached, were classified as not in care but not as LTFU), and 2) the proportion of HEIs who tested positive for HIV at six weeks. Only infants with available DNA PCR results were eligible for the latter outcome. All outcomes were documented in the mother-infant register.

Statistical analysis

Proportions in the intervention and control groups were compared using Pearson’s Chi-square. Log-binomial models were used to estimate unadjusted risk ratios (RR) and 95% confidence intervals (CI) for each of the outcomes. Generalized estimating equations were used to adjust for potential clustering at the clinic level. Analyses were also adjusted for any baseline characteristic that was found to be imbalanced between groups or hypothesized as a strong predictor of a primary outcome. Baseline characteristics considered included: participant’s age in years, marital status (married/cohabitating or other), years of education, gestational age at enrollment, gravity (primigravida: yes or no), the way participants most often went to the clinic (walk or other), time it usually took to get to the clinic (in minutes), and socioeconomic status (SES). Principal components analysis was used to determine the SES measure, and included years of education, average number of household members per room (an indication of crowding), number of sleeping beds in the household, types of household water source (communal or private pipe), cooking fuel type (electrical stove, or wood/charcoal), and ownership status for several durable assets. The first component explained 27% of the variability in the data (factor score was categorized into SES quintile coded 0 to 4, with 0 corresponding to the richest quintile and 4 corresponding to poorest quintile).

Subgroup analyses were conducted to determine the effects of providing incentives to participants with certain demographic and socioeconomic characteristics, timing of ANC registration, disclosure of HIV status, and mode of transport to clinic.

The sample size calculation was based on an expectation that the proportion of participants retained in care and accepting available PMTCT services in the control group would be 50% and that a difference of 15% would be observed due to the intervention g. To show this effect with 90% power ($\alpha=0.05$), 454 participants were needed. LTFU was treated as not retained in care. All analyses were by intent-to-treat, with women kept in their randomized group independent of whether they actually received cash payments. All analyses were completed using SAS 9.3 (SAS Institute, Cary, NC). All tests were two-sided and used a 0.05 significance level.

Role of the funding source and ethical approval

The funder of the study had no role in study design, data collection, data analysis, data interpretation, or writing of the report. The corresponding author had full access to all the data in the study and had final responsibility for the decision to submit for publication. The study was approved by the Institutional Review Board of the Ohio State University and the Ethical Committee of the Kinshasa School of Public Health. All participants provided signed informed consent. Written informed consent and interviews were carried out in Lingala or French.

RESULTS

Participants and recruitment flow

Between April 2013 and August 2014, 612 potential participants were identified. Of those, 67 (10.9%) never returned to the clinic after HIV diagnosis. Of 545 screened, 48 did not meet the eligibility criteria and 64 were excluded (Figure 1). Primary reasons for ineligibility were late registration for ANC (visit after 32 weeks of gestation) ($n = 22$) and not being newly diagnosed with HIV ($n=19$). Primary reasons for exclusion included refusal to accept HIV-positive status ($n = 22$) and enrollment prior to 28 weeks but LTFU before randomization ($n = 16$). Overall, 433 women in 84 participating MCH clinics were randomized to the control (217) and intervention (216) groups. The median number of participants per clinic was 4 (interquartile range [IQR], 2–6) with 11 clinics contributing between 10 and 20 participants each.

Baseline characteristics

Participants in the two study groups had similar characteristics at baseline (Table 1). At baseline, participants had a median age of 29 years [interquartile range (IQR), 25–34], a median of 10 years of education (IQR, 8–12), and a median gestational age of 26 weeks (IQR, 22–28). Most participants (82.9%) were married or cohabitating. Participants reported a median one-way travel time to clinic of 20 minutes (IQR, 10–30) and slightly over half (56.6%) reported walking to their clinic. The median travel time was longer for those who did not walk (31 vs. 24 minutes, $p = 0.05$). The current pregnancy was the first for 12.9% of

participants. Two to four weeks following ANC registration, 23.3% had disclosed their HIV status to someone else, primarily to their partner or a family member.

Primary outcomes

Following randomization, all participants attended at least follow-up visit (Table 2). Comparisons of the intervention and control groups are reported in Table 3. At six weeks postpartum, 23.6% of participants (102/433) were not in HIV care. This included 6.2% (27/433) who had experienced a poor pregnancy outcome and 1.8% (8/433) who were still in care but refused HIV services. Participants in the intervention group, compared to those in the control group, were significantly more likely to be in HIV care [80.6% (174/216) vs. 72.4% (157/217); unadjusted RR, 1.11; 95% CI, 1.00–1.24].

At six weeks postpartum, 67.6% of participants in the intervention group (146/216) had attended all of their scheduled visits on time and accepted all available PMTCT services, compared to 53.5% (116/217) in the control group; unadjusted RR, 1.26; 95% CI, 1.08–1.48.

Adjusting for years of education, marital status, and the mode of transport to the clinic did not substantially change the results for either of the outcomes examined (Table 3).

Secondary outcomes

The intervention group was significantly less likely to be LTFU (10.8%, 23/216) than the control group (20.5%, 44/217), with an unadjusted RR of 0.53 (95% CI, 0.32–0.86). About half ($n = 36$) of total LTFU participants were lost before delivery. Of those, 12 (5.6%) were in the intervention group and 24 (11.1%) were in the control group. If the analysis was restricted to those LTFU before or at delivery, the unadjusted RR was 0.50 (95% CI, 0.24–1.03).

DNA PCR test results were available for 292 infants including 152 and 140 from the intervention and control groups, respectively. Of those infants, five (3.3%) in the intervention group and six (4.3%) in the control group tested positive (unadjusted RR, 0.77; 95% CI, 0.24–2.46).

Subgroup analysis

For retention in care, in all subgroups except for women who had disclosed their HIV status to someone (adjusted RR [aRR], 0.95; 95% CI, 0.79–1.13) and primigravida women (aRR, 0.83; 95% CI, 0.65–1.08), retention was higher in the intervention group than the control group (Table 4). For uptake of PMTCT services, the effect of the intervention was strongest among participants in the poorest wealth quintile (aRR, 1.33; 95% CI, 1.01–1.76), those who walked to the clinic (aRR, 1.39; 95% CI, 1.15–1.69), those who initiated ANC after 20 weeks of gestation (aRR, 1.29; 95% CI, 1.08–1.53), multigravida women (aRR, 1.39; 95% CI, 1.18–1.63), and women who had not disclosed their HIV status (aRR, 1.42; 95% CI, 1.17–1.72).

Amount of incentive payments

The total amount of incentive payments to participants in the intervention group ranged from \$5 to \$45, with a median of \$26 (IQR, \$18–\$35). One participant randomized to the control group received incentive payments totaling \$35 and was retained in care at six weeks postpartum. Based on the costs of the incentives alone and the measured differences in retention between the intervention and control groups, the intervention had a cost of \$317 per additional person retained in care (number needed to treat [NNT] = 12) or of \$184 per additional participant with full uptake of PMTCT services (NNT = 7).

DISCUSSION

Retention and uptake of services along the PMTCT cascade are vital for reducing vertical transmission and achieving the global goal of an HIV-free generation. There is an urgent need for strategies that enhance the effectiveness of PMTCT interventions. In this randomized controlled trial, we found that offering HIV-infected pregnant women small, escalating cash incentives starting at 28 weeks of gestation led to increased retention in care at six weeks postpartum and higher complete utilization of PMTCT services (as measured by attendance of all clinic visits and receipt of available services through six weeks postpartum). We also found that participants who were offered incentives were less likely to be LTFU between 28 weeks of gestation and six weeks postpartum. The effects of the intervention on retention in care and on uptake of available services were stronger among participants in the poorest wealth quintile, those who walked to the clinic, multigravida women, and those who had not disclosed their HIV status, suggesting that conditional cash transfers made directly to these more vulnerable women might increase their control over financial resources as well as empower them to make decisions about utilization of needed health care services.

To our knowledge, this is the first trial to evaluate the effectiveness of financial incentives for improving retention in and uptake of PMTCT services. Our results are consistent with the theoretical rationale for using incentives to modify health behaviors, and with studies showing that incentive or compensation provision can be used to achieve increased uptake of HIV prevention services such as HIV testing,²¹ medical male circumcision,¹⁷ and linkage to HIV care.²² Our results are also consistent with studies in low- and high-income countries that report positive effects of incentives on school attendance,^{23,24} vaccination uptake,¹⁹ smoking cessation,²⁵ and weight loss.²⁶ The results are also in contrast to recent studies that did not show effectiveness of incentives to promote ART adherence and retention in care in the US.²⁷ Overall, however, the results expand the generalizability of findings from research on financial incentives to promote positive health behavior.

A novel feature of the incentive intervention evaluated in this study is the inclusion of a pre-defined incentive schedule that started at \$5 for the first visit and escalated by \$1 for each subsequent visit, with a reset contingency whereby the incentive declined to \$5 in case of a missed visit or not accepting services. Such an incentive scheme further incentivized continued retention in care and resembled schemes that have previously been used in contingency management interventions to promote continued abstinence from substance abuse in the US.^{28,29} The feasibility of implementing such an incentive scheme was

enhanced by the fact that this study focused on a clearly defined antenatal and postpartum period, and was conducted in a clinical setting.

This study had several limitations. First, a substantial number of potential participants ($n = 45$) were not randomized either because they refused their HIV-infected status ($n = 22$), were LTFU before randomization ($n = 26$), or returned to clinic after the randomization window ($n = 7$). We do not know the impact of not including these potential participants on the results, however, these women were disproportionately poor (48% in the two poorest quintiles), suggesting that if the financial incentives were given at the first visit, some of the women who were LTFU may have stayed in care and some of those who returned late would have been more adherent, increasing the observed positive effect of the intervention. Second, a small sample size was enrolled in many clinics, meaning that treatment arms were not balanced among the clinics, with 14 clinics including only one participant and only 49 clinics having balanced enrolment between the arms. Third, because of small sample sizes and limited statistical power, our comparisons of the intervention's effects in different subgroups should be considered as exploratory. Fourth, the study did not examine whether alternative forms of conditional economic compensation (e.g., noncash, or lower/higher amounts) were less, equally, or more effective in increasing retention in care and uptake of services. Additional testing of such strategies in PMTCT settings is needed in order to identify the most efficient and effective strategies. Fourth, the intervention and follow-up was stopped at six weeks postpartum; thus, the effect of the intervention on retention in postpartum care remains to be fully evaluated. Finally, further testing is necessary to determine the generalizability of our intervention and results to settings outside the DRC. However, the fact that the effect appears to be stronger in poorer women and multigravida women suggests stronger effects could be observed in rural populations.

There has been tremendous progress in strengthening retention in PMTCT services in the participating clinics since the study was conceived, as illustrated by the high retention in care in the control group, which was higher than any of our planned scenarios for sample size calculation. However, it is important to point out that the PMTCT program in DRC continues to face severe logistical problems such as drug or test stock-outs, which explained the delay in getting the DNA PCR test results, even for participants who were fully adherent to scheduled visits and had provided a blood sample.

Given the growing recognition that factors such as low retention in care, linkage to care, and failure to deliver in a healthcare facility are limiting the effectiveness of available PMTCT interventions, the findings from this study suggest a promising, feasible approach that can help further the goal of reducing vertical transmission. Further consideration of logistical aspects associated with scaling up incentive-based interventions is needed, as is a formal cost-effectiveness analysis of the intervention that includes not only the costs of the incentives but also the administration costs and data on infections averted. Additionally, more in-depth examinations, including qualitative analyses, of the mechanisms by which cash incentive interventions increase desired PMTCT outcomes would enhance our understanding how these interventions work and improve our ability to design and scale up similar interventions for PMTCT and other health and social issues.

Strengths of this study include its implementation in a resource-limited setting and high- and low-volume clinics, suggesting that the results may be generalizable to similar contexts. The study also suggests the potential benefits of designing incentive schemes that offer repeated payments during a limited time period, include escalating payments to reward the achievement of target behaviors, and have reset contingencies to disincentivize missed visits.

Among newly diagnosed HIV-infected women, small, cash incentives resulted in significantly higher retention along the PMTCT cascade and better uptake of available services. The cost-effectiveness of these incentives and their effects on HIV-free survival warrant further investigation.

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PANEL**Research in Context****Evidence before this study**

The use of financial incentives, such as conditional cash transfers (CCTs), have been promoted as a promising way to achieve changes in health behavior in low- and middle-income countries. Several randomized controlled trials (RCTs) have shown that incentive-based interventions can be effective in increasing uptake of preventive health services, including HIV testing and medical male circumcision, while there is less evidence in support of the effectiveness of incentives for promoting adherence to HIV treatment or retention in HIV care. However, no studies to date have assessed the effectiveness of CCTs on behaviors and outcomes related to the prevention of mother-to-child-transmission of HIV (PMTCT). A 2012 systematic review of financial incentives for HIV prevention behaviors did not find any studies assessing the impact of financial incentives on PMTCT outcomes. On September 3, 2015, a PubMed search with the terms (cash transfer or financial incentive) and HIV yielded 30 RCTs, none of which was focused on PMTCT outcomes.

Added value of this study

Among newly diagnosed HIV-infected women in the Democratic Republic of Congo, small, incremental financial incentives resulted in significantly higher retention along the PMTCT cascade and significantly improved uptake of available services. Although the study was not powered to assess any difference in HIV-free survival, there was a slight tendency towards a lower transmission rate in the intervention group.

Implication

While the scalability and cost-effectiveness of CCTs as a strategy to optimize PMTCT outcomes warrant further investigation, the findings from this study suggest a promising, feasible approach that can help further the goal of reducing vertical transmission of HIV.

^a Some mothers with negative pregnancy outcomes continued HIV services through six weeks postpartum

Figure 1.

Participants and recruitment flow

^aWomen who gave birth in a facility other than where they received ANC (all deliveries with documented place of delivery occurred in a health facility). ^bWomen whose whereabouts was unknown at six weeks postpartum. ^cWomen seen at six weeks, but who refuse to continue HIV care. Abbreviations: ANC, antenatal care; LTFU, lost to follow-up

Table 1

Characteristics of the 433 participants at enrollment in 87 maternal and child health clinics in Kinshasa, DRC between April 2013 and August 2014.

	Overall	Study group	
		Intervention	Control
Age in years: median (IQR)	29.0 (25.0–34.0)	29.5 (26.0–34.0)	29.0 (25.0–34.0)
Gestational age in weeks: median (IQR)	26.0 (22.0–28.0)	26.0 (22.0–28.0)	26.0 (22.0–29.0)
Time to the clinic in minutes: median (IQR)	20.0 (10.0–30.0)	20.0 (10.0–30.0)	20.0 (15.0–30.0)
Maternal education in years: median (IQR)	10.0 (8.0–12.0)	10.0 (8.0–12.0)	10.0 (8.0–12.0)
Marital status: (n,%)			
Married/cohabitating	358 (82.9)	178 (82.8)	180 (82.9)
Divorced/separated/widow/never married	74 (17.1)	37 (17.2)	37 (17.1)
Primigravida: (n,%)			
Yes	56 (12.9)	30 (13.9)	26 (12.0)
No	377 (87.1)	186 (86.1)	191 (88.0)
Earliest ANC visit: (n,%)			
<20 weeks	82 (18.9)	44 (20.4)	38 (17.5)
20 weeks	351 (81.1)	172 (79.6)	179 (82.5)
HIV disclosure to anyone: (n,%)			
Yes	101 (23.3)	53 (24.5)	48 (22.1)
No	332 (76.7)	163 (75.5)	169 (77.9)
Wealth quintile:^a (n,%)			
Fifth (richest)	90 (20.8)	44 (20.4)	46 (21.2)
Fourth	86 (19.9)	42 (19.4)	44 (20.3)
Third	87 (20.1)	47 (21.8)	40 (18.4)
Second	85 (19.6)	43 (19.9)	42 (19.4)
First (poorest)	85 (19.6)	40 (18.5)	45 (20.7)
Transport to clinic: (n,%)			
Walk	245 (56.6)	118 (54.6)	127 (58.5)
Other	188 (43.4)	98 (45.4)	90 (41.5)

^a A wealth quintile score variable was created using principal component analysis (PCA). Twelve variables were included in the PCA: years of education, the average number of household members per room (an indication of crowding), the number of sleeping beds in the household, categories of household water source (communal or private pipe) and cooking fuel type (electrical stove, or wood/charcoal), and ownership status of the following durable assets: radio, television, mobile telephone, refrigerator, and car. Abbreviations: ANC, antenatal care; IQR, interquartile range.

Table 2

Compliance to conditionalities at each follow-up visit after randomization among the 433 participants enrolled in 84 maternal and child health clinics in Kinshasa between April 2013 and August 2014

	Intervention		Control	
	Yes ^a	No	Yes ^a	No
Follow-up visit 1	N = 216^c		N = 217^c	
Attended within the window period (+/- 5 days)	209 (96.8)	7 (3.2)	203 (93.6)	14 (6.4)
Provide blood sample (CD4 count/Hgb) *	211 (97.7)	5 (2.3)	211 (97.2)	6 (2.8)
Enrolled into HIV care and started ART *	215 (99.5)	1 (0.5)	213 (98.2)	4 (1.8)
All conditionalities completed	205 (94.9)	11 (5.1)	198 (91.2)	19 (8.8)
Follow-up visit 2	N = 188^c		N = 184^c	
Attended within the window period (+/- 5 days)	175 (93.1)	13 (6.9)	158 (85.9)	26 (14.1)
Provide blood sample (CD4 count/Hgb) *	179 (99.4)	1 (0.6)	166 (99.4)	1 (0.6)
Enrolled into HIV care and started ART *	180 (100.0)	0	166 (99.4)	1 (0.6)
All conditionalities completed	174 (92.6)	14 (7.4)	156 (84.8)	28 (15.2)
Follow-up visit 3	N = 95^c		N = 96^c	
Attended within the window period (+/- 5 days)	89 (93.7)	6 (6.3)	85 (88.5)	11 (11.5)
Provide blood sample (CD4 count/Hgb) *	92 (100.0)	0	89 (100.0)	0
Enrolled into HIV care and started ART *	92 (100.0)	0	89 (100.0)	0
All conditionalities completed	89 (93.7)	6 (6.3)	85 (88.5)	11 (11.5)
Follow-up visit 4	N = 17^c		N = 17^c	
Attended within the window period (+/- 5 days)	14 (82.4)	3 (17.6)	14 (82.4)	3 (17.6)
Provide blood sample (CD4 count/Hgb) *	14 (100.0)	0	15 (100.0)	0
Enrolled into HIV care and started ART *	14 (100.0)	0	15 (100.0)	0
All conditionalities completed	14 (82.4)	3 (17.6)	14 (82.4)	3 (17.6)
Delivery	N = 204^d		N = 193^d	
Deliver in one of the study facilities	178 (87.3)	26 (12.7)	164 (85.0)	29 (15.0)
Provide blood sample (CD4 count/Hgb) *	203 (99.5)	1 (0.50)	183 (94.8)	10 (5.2)
Enrolled into HIV care and started ART *	204 (100.0)	0	189 (97.9)	4 (2.1)
All conditionalities completed	178 (87.3)	26 (12.7)	158 (81.9)	34 (18.1)
Six weeks postpartum visit	N = 204^c		N = 193^c	
Attended within the window period (+/-5day)	166 (81.4)	38 (18.6)	144 (74.6)	49 (25.4)
Provide blood sample (CD4 count/Hgb) *	173 (99.4)	1 (0.6)	153 (97.5)	4 (2.5)
Enrolled into HIV care and started ART *	174 (100.0)	0	156 (99.4)	1 (0.6)
DBS for early infant diagnosis *	172 (98.9)	2 (1.2)	155 (98.7)	2 (1.3)
All conditionalities completed	164 (80.4)	40 (19.6)	138 (71.5)	55 (28.5)

^aFor blood sample, participants were classified as compliant if they provided a blood sample at a previous or current visit, or if they accepted to a provide blood sample even if for some reason the sample was not collected. For Enrollment into HIV care and initiation of ART, participant were

considered to be adherent if they were not referred (CD4>350, or missing), if they have accepted the referral (first visit when CD4 visit became available), or subsequently if they have registered in the HIV care program and was receiving the best available regimen they were eligible to.

^b Does not include loss to follow-up (LTFU). Overall, all participants attended at least one follow-up visit after randomization; in the intervention group, 6, 3, and 3 participants were LTFU after the first, second, and third follow-up visits, respectively, compared to 15, 7, and 2 participants in the control group.

^c include all participants eligible for the visit.

^d Do not include the 36 who were known to no longer be in care at the time of delivery.

^{*} Only include participant who attended the visit

Abbreviations: DBS = Dried blood spot; Hgb = Hemoglobin

Table 3

Effects of conditional cash compensation on retention in care, uptake of PMTCT services, and loss to follow-up at six weeks postpartum among the 433 participants enrolled in 84 maternal and child health clinics in Kinshasa between April 2013 and August 2014

	Study Group		Risk Ratio (95% CI)			
	Intervention n (%)	Control n (%)	Unadjusted ^a	p-value	Adjusted ^b	p-value
In care at six weeks postpartum ^c						
Yes	174 (80.6)	157 (72.4)	1.11 (1.00–1.24)	0.0548	1.13 (1.02–1.26)	0.0243
No	42 (19.4)	60 (27.7)	1		1	
Attended each clinic visit and received services						
Yes	146 (67.6)	116 (53.5)	1.26 (1.08–1.48)	0.0037	1.31 (1.12–1.54)	0.0009
No	70 (32.4)	101 (46.5)	1		1	
LTFU at six weeks postpartum ^d						
Yes	23 (10.8)	44 (20.5)	0.53 (0.32–0.86)	0.0099	0.53 (0.32–0.86)	0.0108
No	191 (89.3)	171 (79.5)	1		1	
LTFU before or at delivery ^d						
Yes	12 (5.6)	24 (11.1)	0.50 (0.24–0.1.03)	0.0604	0.50 (0.24–1.03)	0.0585
No	204 (94.4)	193 (88.9)	1		1	

^aResults from log-binomial regression models with study group as explanatory variable (reference = control group).

^bResults from log-binomial regression models with study group as explanatory variable (reference = control group) and age, marital status, and education as covariates.

^cAny participant known to be receiving HIV care at six weeks were considered to be in care otherwise they were classified as not in care irrespective of the actual reason for not being in care (maternal death, refusal).

^dLTFU = lost to follow-up: any participant whose whereabouts was unknown at the time point considered.

All confidence intervals and p-values are adjusted for clustering at the level of the clinic using generalized estimating equation

Table 4

Subgroup analysis of the effects of conditional cash compensation on retention in care and uptake of PMTCT services among the 433 participants enrolled in 84 maternal and child health clinics in Kinshasa between April 2013 and August 2014

	N (%)	Risk Ratio (95% CI)		Risk Ratio (95% CI)	
		Unadjusted ^a	Adjusted ^b	Unadjusted ^a	Adjusted ^b
Retention in care					
Uptake of PMTCT services					
Earliest ANC visit					
<20 weeks	82 (18.9)	1.07 (0.85–1.35)	1.12 (0.92–1.39)	1.32 (0.93–1.85)	1.17 (0.92–1.50)
20 weeks	351 (81.1)	1.12 (0.99–1.27)	1.13 (1.01–1.28)	1.25 (1.05–1.49)	1.29 (1.08–1.53)
HIV disclosure to anyone					
Yes	101 (23.3)	0.98 (0.79–1.22)	0.95 (0.79–1.13)	0.97 (0.74–1.68)	0.99 (0.75–1.31)
No	332 (76.7)	1.16 (1.03–1.29)	1.17 (1.06–1.30)	1.37 (1.13–1.66)	1.42 (1.17–1.72)
Wealth quintile ^c					
Fifth (richest)	90 (20.8)	0.99 (0.79–1.22)	0.95 (0.79–1.13)	1.25 (0.92–1.69)	1.17 (0.86–1.61)
Fourth	86 (19.9)	1.12 (0.88–1.41)	1.04 (0.84–1.31)	1.33 (0.92–1.94)	1.27 (0.88–1.81)
Third	87 (20.1)	1.02 (0.81–1.28)	1.15 (0.88–1.50)	1.28 (0.93–1.76)	1.36 (0.99–1.86)
Second	85 (19.6)	1.29 (1.02–1.63)	1.31 (1.04–1.65)	1.16 (0.76–1.79)	1.34 (0.91–1.96)
First (poorest)	85 (19.6)	1.20 (0.98–1.46)	1.12 (0.97–1.41)	1.30 (0.97–1.75)	1.33 (1.01–1.76)
Primigravida					
Yes	56 (12.9)	0.83 (0.63–1.08)	0.84 (0.65–1.08)	0.82 (0.58–1.16)	0.88 (0.61–1.27)
No	377 (87.1)	1.16 (1.03–1.26)	1.18 (1.05–1.33)	1.35 (1.15–1.59)	1.39 (1.18–1.63)
Walk to clinic					
Yes	245 (56.6)	1.17 (1.04–1.32)	1.17 (1.04–1.31)	1.37 (1.14–1.66)	1.39 (1.15–1.69)
No	188 (43.4)	1.05 (0.87–1.26)	1.04 (0.87–1.26)	1.13 (0.85–1.51)	1.19 (0.90–1.58)

^aResults from bivariate log-binomial regression models (reference = control group)

^bResults from multivariate log-binomial regression models with study group as explanatory variable (reference = control group) and age, marital status, and education as covariates.

^cA wealth quintile score variable was created using principal component analysis (PCA). Twelve variables were included in the PCA: years of education, the average number of household members per room (an indication of crowding), the number of sleeping beds in the household, categories of household water source (communal or private pipe) and cooking fuel type (electrical stove, or wood/charcoal), and ownership status for the following durable assets: radio, television, mobile telephone, refrigerator, and car.

All confidence intervals are adjusted for clustering at the level of the clinic using generalized estimating equations.