Engagement of men in antenatal care services: Increased HIV testing and treatment uptake in a community participatory action program in Mozambique

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Abstract

Uptake of HIV testing and antiretroviral therapy (ART) services during antenatal care (ANC) in rural Mozambique is disappointing. To nurture supportive male engagement in ANC services, we partnered with Traditional Birth Attendants and trained a new type of male-to-male community health agent, "Male Champions", who focused on counseling male partners to create new, male-friendly community norms around engagement in spousal/partner pregnancies. We assessed ANC service uptake using a pre-post intervention design. The intervention was associated with increases in: (1) uptake of provider-initiated counseling and testing among pregnant woman (81% vs. 92%; p<0.001); (2) male engagement in ANC (5% vs. 34%; p<0.001); and (3) uptake of ART (8% vs. 19%; p<0.001). When men accepted HIV testing, rates of testing rose markedly among pregnant women. With the challenges in scale-up of Option B+ in sub-Saharan Africa, similar interventions may increase testing and treatment acceptability during pregnancy.

Keywords

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INTRODUCTION

Prevention of mother-to-child HIV transmission (PMTCT) has been a priority in low- and middle-income countries (LMIC) since the discovery of the 50% efficacy of single dose nevirapine given to a woman in labor and to her newborn (1). For PMTCT, all pregnant women must receive antenatal care (ANC) that includes provider-initiated HIV counseling and testing (PITC), and antiretroviral therapy (ART). Since the advent of the US President's Emergency Plan for AIDS Relief (PEPFAR) and the Global Fund to Fight AIDS, Tuberculosis, and Malaria, clinical infrastructures in LMIC have improved, sometimes enabling optimized maternal and child health (MCH) care with the provision of lifelong combination ART to pregnant women, termed World Health Organization (WHO) Option B + (2). In 2013, the WHO estimated that only 68% of HIV-infected pregnant women received a recommended regimen for PMTCT (3). While substantial progress has been made, we are years away from the goal of eliminating mother to child transmission in rural sub-Saharan Africa (SSA).

Until recently, PMTCT programs have focused primarily on HIV-positive women, a strategy that is divorced from the context of family dynamics and gender disparities (4–10). Most interventions to increase ANC service uptake have resulted in increased ART uptake among HIV positive pregnant women, (11–17) but many programs have struggled with scale-up (12, 18, 19) and patient acceptability (14, 18, 20–23). In communities where women are restricted from making independent HIV-related health decisions, the WHO, implementing partner organizations, and national health services have encouraged the inclusion of male partners in ANC services to increase uptake of PMTCT services, supplementing couples counseling whenever possible (6, 24–28). Some, but not all, programs have resulted in improved PMTCT uptake (29, 30). Different models of male engagement have been implemented throughout sub-Saharan Africa (SSA) to increase partner accompaniment, including encouraging women to invite their own partners (4, 17), the use of clinic invitation letters (5, 31), and having community health educators/advocates visit couples' homes to initiate testing recruitment and/or counseling (31, 32). A systematic Cochrane review that reviewed a single eligible study from Tanzania cautioned that this strategy could lead to a paradoxical decreased uptake of ANC services, including HIV testing and PMTCT, if women feared participating in partners-based testing (30, 33). Engaging men may also lead to gender-based violence, if couples are serodiscordant (34, 35). Given a lack of standardization of interventions and varying rigor in evaluation of impact, it is not surprising that both success and failure are reported, with uncertainties as to best practices and whether the added costs of male partner engagement have an evidence-based justification (8, 25, 36, 37).

In Mozambique, nearly 150,000 HIV-infected women give birth annually (38, 39). ANC services are offered at 86% of government-run clinics (40) and opt-out HIV testing and antiretroviral (ARV) medications are provided free-of-charge. Yet rural HIV outcomes have been disappointing for both HIV-infected women and infants (41, 42). Vanderbilt University (VU), through its affiliate, Friends in Global Health (FGH), is funded by the PEPFAR to support HIV/AIDS care and treatment services in 81 sites in 10 rural districts of Zambézia province. One of the world's poorest and most medically underserved regions, Zambézia

had an estimated adult HIV prevalence of 12.6% in the most recent serosurvey in 2009 (39). According to a 2011 Demographic and Health Survey (DHS), only 74% of pregnant women in Zambézia attended at least one prenatal care visit and only 28% had received PITC (43).

In rural Mozambique, women are socially obligated to ask permission from their male partners before making decisions about their own health care utilization. However, strong social taboos oppose male engagement in ANC (44, 45). Women's fears of going to the clinic alone and their inability to obtain permission from their partners represented half of the reported barriers to ANC PITC uptake in a national survey (43). In response to low ANC uptake during pregnancy and high refusals of HIV services among those who did attend ANC, FGH partnered with Traditional Birth Attendants (TBAs), clinicians, and community members to develop a community-based intervention to increase acceptability of ANC service uptake among pregnant women and their partners. The intervention was developed over a 6-month period, through key informant interviews, focus group discussions (FDGs), and community meetings. We partnered with TBAs as ANC and PITC advocates and trained a new type of male-to-male community health agent, "Male Champions" (MCs), who focused on counseling male partners to create new, male-friendly community norms around engagement in spousal/partner pregnancies. The study objectives were to increase uptake of ANC services, including HIV testing and treatment, as well as maternal delivery at the health facility. We describe the impact of this community-participatory program in four communities in central Mozambique.

METHODS

Design Overview

Pregnant women and their partners were approached for participation in the male engagement study. The study was designed to evaluate the impact of a community-based intervention on male engagement in ANC services and the impact of male partner engagement on uptake of ANC services, including ART, and health center delivery. Male engagement was defined as partner accompaniment to ANC services at least one time during the pregnancy. Vanderbilt University, in partnership with Friends in Global Health in Mozambique, coordinated the study. ANC and maternity data were collected at four Mozambican health centers.

Ethical Approvals

All participants provided written informed consent. This study was approved by the Vanderbilt University Institutional Review Board (IRB number: 120712) and the *Comité Nacional de Bioética a Saúde* in Mozambique (IRB number: 244/CNBS/12).

Setting and Participants

We engaged all pregnant women ≥18 years of age with a living male partner who attended at least one ANC service in four rural communities (Bingagira, Gonhane, Palane Mukula, and Mucupia) in Inhassunge district from 1 June 2012 to 30 March 2014. Inhassunge is a small district of ≈100,000 persons, accessible from the provincial capital of Quelimane only by

boat across the *Rio dos Bon Sināis*, followed by up to 90 km of travel via walking or very limited ground transportation on sandy roads (46).

Intervention Design and Background

Using a community participatory research design (47), we partnered with community and religious leaders, clinicians, TBAs, traditional healers, pregnant women, and their partners to develop an intervention that would address information, motivation, and socio-cultural barriers specific to rural Mozambique that impacted uptake of ANC services among pregnant women and their partners (48). The data from these preliminary focus group discussions are detailed in a previously published manuscript (49). This intervention had four components:

1. Integration of all TBAs living in this district into the government health system. TBAs were responsible for identifying pregnant women within their communities, conducting at least one counseling session with the expectant woman about the importance of ANC service uptake, notifying the Male Champions of the woman's status, obtaining the name/location of the woman's partner, and accompanying the women to ANC services, delivery, and post-natal care.

2. Recruiting, training, and deploying Male Champions to facilitate male partner engagement in the ANC services of wives/partners. Male Champions were selected by community leaders and trained as counselors, with specific knowledge in the importance of gender dynamics as well as maternal and child health. They were charged with seeking out the male partner at home, ideally before the pregnant women sought ANC services. The Male Champion counseled the male partner about the importance of ANC uptake as well as couples counseling and testing for HIV, the negative impact of gender-based violence, and the need for men to provide physical and emotional support to their partners during pregnancy. If the male partner refused or could not be located, the MC would make at least two additional attempts. In addition to providing counseling support, the MC accompanied the couple to ANC services to destigmatize the accompaniment behavior (49). One element was not originally part of the intervention, but evolved during the program; in the rare instances where the male partner refused to participate but did not prevent his wife from attending ANC, the Male Champion would accompany the pregnant women and TBA to the clinic himself.

3. "Male-friendly" clinical environment. Based on our qualitative inquiry into desired changes to engage men, we provided specially trained couples counselors and private rooms for HIV testing and family planning. We also encouraged men to attend ANC appointments by providing physical separation from maternity wards and invitations by MCH nurses for waiting men to join their partners.

4. Couples Counseling Sessions. When the couple arrived at the health facility for ANC services they would be brought to a trained couples-focused HIV counseling and testing counselor. This counselor would do a preliminary counseling session to determine if the couple were interested in testing together and learning each other's' test results. If either partner refused, VCT would be offered to each individually, and their HIV serostatus would not be disclosed. If they both consented, they would be immediately provided couples-based VCT (CVCT). After post-test counseling, if both partners agreed, the Male Champion could be told the couple's serostatus by the participants themselves. The Male Champion would subsequently continue home-based support to encourage ART uptake. If the couple tested separately, the woman had the option of disclosing her serostatus to the Male Champion or TBA for continued support during the pregnancy and post-natal period.

During the second year of this intervention, we conducted 23 focus group discussions with TBAs, Male Champions, and the women and male partners who had experienced a pregnancy during the time of the study (one FGD per site per group =20 total), and clinicians providing care (three FGDs). While detailed data are beyond the scope of this article (CMA, unpublished data), we present insights about the challenges to intervention implementation and the impact of a TBA and Male Champion intervention on maternal uptake of ARVs.

Data Collection

We collected data on ANC service utilization (particularly uptake of HIV services), including the number of visits, male partner accompaniment, HIV testing and treatment uptake, and delivery venue from ANC clinical register books at each site. Process measures, including home visits and counseling sessions by TBAs and MCs, were recorded. All persons were offered PITC as per national Mozambique Ministry of Health guidelines (50). When testing was accepted, HIV rapid testing was used (Determine HIV-1/HIV-2®, Abbott Laboratories, Abbott Park, Illinois, USA). If their initial test result was negative, they were counseled accordingly. If their initial (Abbott Determine®) test was positive, they underwent additional HIV rapid testing using an alternative test, namely Unigold HIV-1/HIV-2® (Trinity Biotech Plc, Bray, Co. Wicklow, Ireland). If both tests were positive, then they were confirmed HIV-infected and counseled accordingly. If the initial test was positive (Abbott Determine®) and their confirmatory test was negative, they were deemed indeterminate and asked to return to the clinic in 3–4 months for repeat testing, at which time the testing algorithm would be repeated. Stockouts of HIV test kits are not recorded in the database; to avoid over-classification of patients seen during stockouts as PITC refusals, we excluded from analysis patients enrolled in ANC on days when ≥5 patients were seen, but zero HIV tests were performed (presumed stockout days). About 64% of clinic days had ≥5 patients (n=255) and there were 26 presumed stockout days (7%) among the four clinics, resulting in 4% of pregnant women not receiving an HIV test at their first ANC visit. The calculated sample size was 621 HIV-infected pregnant women entering ANC (207 pre- and 414 post-intervention) to detect a projected increase from 12% to 30% in HAART uptake with 99%

power and 1% type I error using an uncorrected chi-squared statistic. The actual number of HIV-infected pregnant women accrued for this endpoint was 654 (105% of the projected need), but the observed pre-intervention increase in HAART uptake was only 8%.

Our focus group discussions included 198 participants from the four study communities to ensure we could identify any variability in community perspectives. Male Champions and TBAs were randomly selected using the random selection function in Stata® (StataCorp, LP, College Station, Texas, USA) from the pool of active agents in these communities. Community members who had registered a delivery during the study period were recruited via community meetings. We actively recruited several participants who knew of, but had not participated in, the intervention to gain information about their perceptions about the program. All clinicians who provided ANC services were included. Of the 230 people selected/initially volunteered, 32 (13.9%) were excluded (31 were not located and one declined). All participants were 18 years of age or older. No compensation was provided, but focus group participants received a beverage and sandwich during the discussion. To facilitate an open discussion, focus groups were: (1) conducted separately for community (men's and women's groups), clinicians, TBAs, and Male Champions; and (2) conducted with trained interviewers who did not live in the target district, were not associated with the clinical services, and had at least three years of experience conducting qualitative interviews. The questions relevant to the discussion of program implementation (thus presented here) included: 1) What barriers did Male Champions and TBAs encounter to implementing the male engagement strategy as originally planned; and 2) How did Male Champions and/or TBAs impact uptake of ART?

Statistical Analysis

Participant characteristics and service uptake were presented as frequencies with percentages or medians with interquartile ranges (IQR). Participants with first ANC pre-intervention versus those with first ANC post-intervention were compared using Wilcoxon and chi-square tests. Multivariable logistic regression was used to model the impact of partner accompaniment and acceptance of HIV testing on delivery in the health facility, maternal HIV testing, ART initiation, and any ARV drug receipt with intervention period. All models were adjusted for maternal age, gestational age, and clinic. If linearity assumptions were violated, we modeled continuous variables using restricted cubic splines (51). We employed R-software 3.1.1 (www.r-project.org) for all analyses. Analysis scripts are posted at http://biostat.mc.vanderbilt.edu/ArchivedAnalyses.

Qualitative data were transcribed within a week of the interview into the local African language and were subsequently translated into Portuguese by the interviewer and into English by an independent translator. A fourth member of the team, fluent in all three study languages spoken in the region, reviewed the tapes and transcriptions to verify both the translation and transcription. The themes were developed inductively, and comparisons in the attitudes expressed by Male Champions, TBAs, and community members were made using deductive sub-group analysis. This data was included to inform the uptake of clinical services, focusing our analysis on descriptions of intervention delivery and discussions regarding maternal ART uptake and adherence. Two persons participated in the thematic

analysis (LC and CMA), both with extensive experience conducting qualitative research (52). Agreement in coding was reviewed and discrepancies resolved by consensus. A comparison of coding agreement on the first six focus groups found 94% agreement using Cohen's Kappa in MAXQDA® (VERBI GmbH, Berlin, Germany) software.

RESULTS

Clinical Findings

From June 2012 to March 2014, 5,971 unique pregnant women in four study clinics completed a first ANC visit (Table 1). Median age was 25 years (interquartile range (IQR) 19–30) and median gestational age at first visit was 24 weeks (IQR 19–28). All women, regardless of previous test results, were offered HIV testing; 1090 (18%) tested positive. Seventy percent of HIV-infected women accepted some type of antiretroviral perinatal prophylaxis (some, but not all of Zambezia's clinics moved from monotherapy to Option B+ triple therapy). Of the men who accompanied their wives/partners, 1,612 (91%) participated in couples-based VCT. Among male partners who completed PITC, 300 (5%) tested HIV-positive. Of couples who tested together, 45 (15%) were serodiscordant.

During the intervention period 2,928 male partners (67%) were reached by a Male Champion and 4,024 pregnant women (92%) were reached by a TBA. The intervention period was associated with increase in the percentage of male accompaniment at first ANC (5% vs. 34%; p<0.001) or any ANC appointment (10% vs. 37%; p<0.001), male partner testing during ANC (9% vs. 34%; p<0.001), women testing for HIV during ANC (81% vs. 92%; p<0.001), and attendance of three ANC appointments (33% vs. 40%; p<0.001) during the pregnancy. Among pregnant women who accepted ANC-based HIV testing, positive test results were 17% at study commencement and 19% post-intervention (p<0.001). Median gestational age at first ANC appointment decreased slightly post-intervention (24 weeks vs. 23 weeks; p<0.001) but the percentage of women who delivered at the health facility was about the same (24% vs. 25%; p=0.5) (Table 2). Odds of comprehensive ART uptake (as per Option B+) among HIV-infected pregnant women increased substantially (adjusted odds ratio [aOR]: 2.68; 95% confidence interval [95 % CI]: 1.59–4.51; p<0.001) during the intervention period but odds of accessing any form of prophylaxis remained about the same (aOR: 1.09; 95% CI: 0.79–1.50; p=0.6).

Partner accompaniment to ANC throughout the study was associated with higher odds of maternal HIV testing (aOR: 5.98; 95% CI: 4.50–7.94; p<0.001), uptake of three ANC visits (aOR: 1.26; 95% CI: 1.10–1.45; p<0.001), and health facility delivery (aOR: 1.26; 95% CI: 1.08–1.47; p=0.003). Partner acceptance of PITC was associated with higher odds of maternal HIV testing at first ANC visit (aOR 19.4; 95% CI: 11.8–31.7; p<0.001). Conversely, if the partner refused testing for himself, the pregnant woman had lower odds of testing (aOR 0.60; 95% CI: 0.41–0.87; p<0.001). Of the men who accompanied their partners to ANC, 9% refused PITC. Women who were accompanied by their partners to at least one ANC service showed little difference in odds of ART initiation (aOR 0.77; 95% CI: 0.50–1.21; p=0.3) or prophylaxis (single dose nevirapine or intrapartum zidovudine in clinics that had not yet deployed Option B+) compared with unaccompanied women, although the absolute numbers of those accepting treatment increased, given higher

acceptance of HIV testing. There was little difference in ART uptake based on partner status or willingness to test (Table 3). While partner accompaniment was not directly associated with uptake of ART, the intervention itself did result in increased uptake, suggesting other aspects of the intervention led to this behavior change.

Localizing the Intervention

Although the intervention was developed through a community participatory framework, the first six months of delivery revealed several necessary adjustments to ensure successful implementation. Through focus groups with MCs, TBAs, clinicians, and young people in these communities, we learned that the greatest barrier to implementing the intervention was overcoming the negative attitude participants had towards the health facility and health activists. TBAs and Male Champions in all intervention communities were accused of being "sorcerers" who were bringing diseases from the hospital when visiting a patient's home. This resulted in several Male Champions and TBAs experiencing violence from would-be participants:

> 'The husband was taking us [TBA and Male Champion] off the chairs, pushing me, saying that we were the sorcerers here, bringing diseases to them from other kids; that we were getting money and bringing diseases back to them' (TBA, Mucupia).

To address this resistance and the potential suspicion that Male Champions were visiting a home to flirt with the pregnant woman, Male Champions and TBAs began making home visits together and engaged the secretary of the community (a political officer) to accompany them to the first visit. This support from a local political leader increased acceptability of the intervention and reduced the likelihood of violence perpetrated towards the health activist or the pregnant woman:

> 'Before, when the project was just starting, you would get to a couple's house and would almost get punched. So to avoid things like that, before we would go visit a family, we would look for the secretary of that neighborhood and he would accompany us to that person's house' (Male Champion, Palane Mecula).

Overtime this strategy became less necessary as Male Champions and TBAs became well known and the male engagement strategy became more acceptable. While barriers remained, community members, TBAs, Male Champions and clinicians reported that acceptability of male engagement in ANC services increased markedly over time. In the last few months of the program, TBAs and Male Champions reported community members seeking their services without prompting. Most telling, community members who had received the intervention reported providing similar counseling to friends and family members.

TBAs and Male Champions usually needed to complete 2–3 visits before a couple accepted the intervention. During these visits, Male Champions describe the process of providing information about pregnancy and HIV, encouragement, reassuring that they will attend clinic with them, and even marital advice to the male partner:

> 'You tell them to go to the hospital, but if she or he denies it then you try to go back another day and ask, 'Brother, why haven't you gone yet? I'm not seeing you do

anything. I'm ok because I went there (to the hospital), so you should also go help your wife and accompany her to the hospital' (Male Champion, Bingagira).

While the Male Champions counseled the husband, the TBA counseled the pregnant woman. Beyond seeking their own care, community members also described their informal involvement in promoting male engagement:

> 'When the Male Champion came for the first time [during my wife's pregnancy] they told me I had to go to the hospital and at first I rejected the idea. But when they went to my house the second time I accepted going to the hospital. So my friend asked about the treatment and I counseled him too. I personally advised him to go check out what the Men for Health [MCs] were saying. He accepted it and came back saying how good it was. So after he met with them, he and his wife registered [at the hospital]' (male community member, Palane Mecula).

The engagement of community men as "informal champions" was the long-term goal of the program and was the focus of community theater presentations and educational lectures.

Prophylaxis Acceptance

TBAs, MCs, and community members explained social norms relevant to why male engagement does not appear to impact ART uptake. While all participants discussed the presence of "stubborn" women who refused to accept ART services, there was overwhelming belief that the majority of HIV+ women would accept ART while at the clinic, regardless of their intent to adhere to their medication. Our focus group participants argued that women who lack partner support would be less likely to adhere to prescribed medication. A TBA provided one example of a woman who lacked partner support and who had been recorded in the registry as accepting ART:

> 'She [the pregnant woman] came and said, 'Auntie [common nickname for TBA] my husband doesn't want to go [to ANC],' so I told her let's just go the two of us, her belly was already getting big… When she received the medication she was very scared. When we arrived at their house the husband said, 'Didn't I tell you I didn't want this?' The woman then went to lie down and to this day she hasn't done the treatment. She goes for her consultations, medications, and to be weighted, never misses a date, but she isn't taking the medication' (TBA, Mucupia).

A lack of male partner support can range from passive disapproval of her treatment to actively preventing her from taking her medications. In Chiremane, a TBA recalls a patient who accepted ART during pregnancy: "…but when she takes the medication [home] her husband grabs it and hides it. We do not know what to do with that gentleman". In cases like this, the woman who tests alone but is not "allowed" to take the medication by her partner may be misclassified as taking ART.

Intervention Cost

Sustainability of the intervention is a significant concern. Each community was served by about 10 Male Champions (US$30 stipend per month per Male Champion), 12 TBAs ($10 per month per TBA), and a dedicated couples-based HIV counselor ($216 per month each). The cost of each male partner accompanied to the health facility by a Male Champion

worked out to $9.50. TBAs were considerably less expensive: the cost of counseling a pregnant woman was $2.92 while accompaniment was $5.12 per woman.

DISCUSSION

Women in diverse African settings have identified lack of support from husbands or male partners as an important barrier to engagement in ANC and HIV testing services (7, 53, 54). PMTCT programs have struggled with the difficulty of engaging men in ANC services, including PITC, given that ANC is not designed to accommodate the schedules, preferences, and health of the male partner. Qualitative (6, 7, 26, 55) and clinical data (33) across SSA reveal that women are reluctant to accept HIV testing if their partners are unsupportive, highlighting the importance of partner support and shifting social gender norms. Our study demonstrated what can be achieved when communities form partnerships, even in the most remote, impoverished, rural settings. When male partners accepted HIV testing in ANC, women had over 19 times higher odds of accepting PITC than if they came to ANC unaccompanied. But, when men refused testing, women were less likely to test, revealing the importance of quality home-based counseling by MCs and the use of a screening tool to filter unsupportive male partners.

We hypothesized that increased male support, particularly if the partner also tested positive, would increase uptake of maternal PMTCT. However, our data suggested that regardless of partner HIV status, male partner engagement and testing was not associated with higher maternal uptake of ART. Interestingly, our overall intervention did result increased ART uptake. We hypothesize that TBAs effectively counselled women about the importance of ART, leading to increased uptake. Our qualitative data from focus group discussions suggest that male support for ART does impact behavior; community members suggest that women with unsupportive partners will uptake ART at equal rates (given pressure from clinicians to accept treatment), but they will be less likely to adhere to the regimen. A previous study in the same province highlights the negative impact of partner disapproval on engagement in care from partner disapproval (56). Hence, measuring ART initiation without assessing maternal adherence may result in an inflated estimate of the proportion of infants protected from mother-to-child transmission; uptake of the intervention is not the same as adherence (57). This is an important area of future research.

In addition to influencing ANC service uptake behavior, TBAs and Male Champions counseled male partners to: (1) recognize their wives as human beings with feelings similar to their own; (2) speak out against gender-based violence; and (3) assist their partners with housework and farming during pregnancy. These social norms were targeted to create a sustainable model of behavior change that would eventually not rely on support of our community team. Given the increased acceptability of the intervention and reports of MCs and TBAs, we believe male engagement in ANC will become a social norm. One of the greatest concerns expressed about this project is financial sustainability, given the community infrastructure required to maintain the project. We are currently scaling-up this project in another district, with fewer Male Champions (3–4) and TBAs (4–6), in order to assess the feasibility of achieving similar male engagement levels with a smaller financial investment. In this setting, our preliminary data suggest an increase in male engagement

from 5% to 47% in three months, proposing the feasibility of scaling up this concept in a different setting, with fewer resources.

Strengths and Limitations

The strengths of our study include the ability to follow pregnant women longitudinally, from first ANC visit through delivery. In addition, the continuous community engagement and support, developed through community-based participatory research, suggests that the impact on social norms and beliefs may be sustainable, but that designing an intervention that is acceptable to all community members is a challenge. While the program was acceptable to most at the beginning, some men did not accept the intervention without encouragement from another community leader. Our program had to be nimble enough to adjust for this social barrier in the early phases, before the MCs became known and accepted in the community. Study limitations include vulnerability to the bias of calendar time effects as a pre-post study (i.e. interrupted time series design), and the need to create longitudinal ANC data from cross-sectional registries (linked on name, maternal and gestation age, and community). This process could have resulted in undercounting attendance of follow-up visits if any of these data were missing or incorrectly recorded.

Conclusions

Engaging men in face-to-face sessions in their homes, in community meeting venues, and at clinic sites to encourage engagement in ANC services is a feasible and effective strategy. By including TBAs as partners in ANC service delivery, we were able to access expectant couples who may or may not have sought ANC services and ensure that women would have local support for ANC uptake. Similarly, the Male Champions provided peer support for a culturally unfamiliar action, namely the accompaniment of wives/partners to ANC. Finally, our ANC-based structural adjustments to make ANC friendlier to men were vital to program success. The success of WHO Option B+ in eventual elimination of mother-to-child transmission of HIV may depend on male partner engagement, which was found in our study to be associated with increased testing acceptability among pregnant women. With the challenges in Option B+ scale-up across sub-Saharan Africa, our intervention can be implemented to increase partner acceptance of an HIV diagnosis, resulting in greater impact on health outcomes for both mother and infant. Our study described the impact of increased male partner engagement on maternal testing; while treatment uptake among pregnant women with engaged partners did not improve, qualitative data suggest that adherence among women with supportive partners is higher.

We believe that men need to be recruited as maternal-child health advocates for the ultimate success of PMTCT and HIV clinical outcomes in SSA, and this engagement must be coupled with counseling and education of both partners and advocacy for behavior change in the community. Our model for community engagement and partner support may be relevant to many other settings in LMICs and potentially far more cost-effective than other strategies to increase coverage. This strategy to create socially acceptable and sustainable behavior change can be applied to a host of other health conditions where adherence to therapy is vital, and may also be gender-reversible, i.e. advocacy for women to accompany men to support their care. Implications for gender-based violence reduction are apparent, but as of

yet, unproven. Tackling the remote rural regions of Africa to achieve elimination of mother-to-child transmission of HIV and to provide lifelong ART to infected parents is feasible; our data suggest an important role for male engagement in ANC.

Acknowledgments

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Table 1

Summary of pregnant women and male partners seen in the rural Inhassunge District, Zambézia Province, Mozambique by Clinic Site, June 2012–March 2014.

	Bingagira (n=903)	Gonhane (n=1711)	Palane Mukula (n=1122)	Mucupia (n=2235)	All 4 clinics (n=5971)
Median Maternal Age in years (interquartile range [IQR])	24 (19 – 29)	27 (20 – 30)	24 (19 – 28)	24 (19 – 30)	25 (19 – 30)
Median Gestational Age in weeks at first visit (IQR)	21 (18 – 26)	26 (20 – 29)	21 (19 – 25)	24 (18 – 28)	24 (19 – 28)
HIV Status at ANC, n (%)					
Negative	596 (66%)	1277 (75%)	711 (63%)	1635 (73%)	4219 (71%)
Positive[1]	161 (18%)	257 (15%)	194 (17%)	478 (21%)	1090 (18%)
No Test	146 (16%)	177 (10%)	217 (19%)	122 (5%)	662 (11%)
Male Partner Present (1st visit)	444 (49%)	511 (30%)	359 (32%)	260 (12%)	1574 (26%)
Male Partner Present (any visit)	484 (54%)	568 (33%)	427 (38%)	293 (13%)	1772 (30%)
Male Partner HIV Status at ANC, n (%)					
Negative	364 (40%)	456 (27%)	292 (26%)	200 (9%)	1312 (22%)
Positive[2]	59 (7%)	78 (5%)	93 (8%)	70 (3%)	300 (5%)
No Test	480 (53%)	1177 (69%)	737 (66%)	1965 (88%)	4359 (73%)

[1] If initial (Abbott Determine®) test was positive, additional HIV rapid testing using Unigold HIV-1/HIV-2® was used to confirm HIV status.

Table 2

Summary of pregnant women and male partners seen in the rural Inhassunge District, Zambézia Province, Mozambique by intervention period, June 2012–March 2014.

	Women seen pre-intervention (n=1616)	Women seen post-intervention (n=4355)	All women (n=5971)	P- value[1]
Median Maternal Age in years (interquartile range [IQR])	25 (20 – 29)	25 (19 – 30)	25 (19 – 30)	0.72
Median Gestational Age in weeks at first visit (IQR)	24 (20 – 28)	23 (18 – 27)	24 (19 – 28)	**< 0.001**
Clinic Site, n (%)				**< 0.001**
Bingagira	252 (16%)	651 (15%)	903 (15%)	
Gonhane	363 (22%)	1348 (31%)	1711 (29%)	
Palane Mukula	312 (19%)	810 (19%)	1122 (19%)	
Mucupia	689 (43%)	1546 (35%)	2235 (37%)	
HIV Status at ANC, n (%)				**< 0.001**
Negative	1037 (64%)	3182 (73%)	4219 (71%)	
Positive[3]	276 (17%)	814 (19%)	1090 (18%)	
No Test	303 (19%)	359 (8%)	662 (11%)	
Male Partner Present at first visit	81 (5%)	1493 (34%)	1574 (26%)	**< 0.001**
Male Partner Ever Present at any visit	157 (10%)	1615 (37%)	1772 (30%)	**< 0.001**
Male Partner HIV Status at ANC, n (%)				**< 0.001**
Negative	112 (7%)	1200 (28%)	1312 (22%)	
Positive[2]	25 (2%)	275 (6%)	300 (5%)	
No Test	1479 (92%)	2880 (66%)	4359 (73%)	
Male Partner Accompaniment and Testing, n (%)				**< 0.001**
Partner Attends and Tests	137 (8%)	1475 (34%)	1612 (27%)	
Partner Attends and No Test	20 (1%)	140 (3%)	160 (3%)	
Partner Does Not Attend	1459 (90%)	2740 (63%)	4199 (70%)	

[1] Participants with first antenatal care visit pre-intervention versus those with first visit post-intervention were compared using the Wilcoxon and Chi-square tests.

[2] If initial (Abbott Determine®) test was positive, additional HIV rapid testing using Unigold HIV-1/HIV-2® was used to confirm HIV status.

Table 3

Antenatal clinic service uptake by intervention period, partner accompaniment, and partner testing: results from multivariable logistic regression models from male partner study in rural Mozambique.

Outcome		Odds Ratio (95% CI)	P-value
Accompaniment[1]	Post-intervention (vs. Pre)	6.03 (5.00, 7.28)	< 0.001
Three ANC visits[2]	Post-intervention (vs. Pre)	1.16 (1.01, 1.32)	0.03
	Male Partner Present (any visit)	1.26 (1.10, 1.45)	< 0.001
	Male Partner Accompaniment		0.003
	Partner does not attend (ref)	1	
	Partner attends and tests	1.25 (1.09, 1.44)	
	Partner attends and no test	1.37 (0.94, 1.98)	
Delivery[2]	Post-intervention (vs. Pre)	1.04 (0.90, 1.20)	0.62
	Male Partner Present (any visit)	1.26 (1.08, 1.47)	0.003
	Male Partner Accompaniment		0.010
	Partner does not attend (ref)	1	
	Partner attends and tests	1.27 (1.09, 1.48)	
	Partner attends and no test	1.18 (0.79, 1.77)	
HIV Testing[3]	Post-intervention (vs. Pre)	2.88 (2.40, 3.46)	< 0.001
	Male Partner Present (any visit)	5.98 (4.50, 7.94)	< 0.001
	Male Partner Accompaniment		< 0.001
	Partner does not attend (ref)	1	
	Partner attends and tests	19.4 (11.8, 31.7)	
	Partner attends and no test	0.60 (0.41, 0.87)	
Antiretroviral therapy Initiation[4]	Post-intervention (vs. Pre)	2.68 (1.59, 4.51)	< 0.001
	Male Partner Present (any visit)	0.77 (0.50, 1.21)	0.26
	Male Partner Accompaniment		0.62
	Partner does not attend (ref)	1	
	Partner attends and tests positive	0.67 (0.37, 1.22)	
	Partner attends and tests negative	0.94 (0.49, 1.80)	
	Partner attends and no test	0.79 (0.22, 2.86)	
Any antiretroviral drug Initiation[5]	Post-intervention (vs. Pre)	1.09 (0.79, 1.50)	0.61
	Male Partner Present (any visit)	1.24 (0.90, 1.71)	0.19
	Male Partner Accompaniment		0.45
	Partner does not attend (ref)	1	
	Partner attends and tests positive	1.36 (0.91, 2.04)	
	Partner attends and tests negative	1.19 (0.76, 1.87)	
	Partner attends and no test	0.91 (0.42, 1.97)	

Every model is adjusted for age, gestational age, and clinic. The last four outcomes had three separate models where exposure was one of: intervention period, partner accompaniment, partner accompaniment and testing.

[1] All women (n=5811).

*2*All women who were due to deliver by March 31, 2014 (n=5327).

*3*All women who visited on days without test kit stockout (n=5153).

*4*HIV-infected women at sites that offer HAART (n=654).

*5*HIV-infected women (n=963). Antiretroviral therapy with three drugs, or dual therapy with nevirapine and zidovudine or nevirapine monotherapy.