Pilot study of home-based delivery of HIV testing and counseling and family planning services to couples in Malawi

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Abstract

Objective: To estimate the uptake of couple HIV counseling and testing (CHCT) and couple family planning (CFP) services in a single home visit in peri-urban Malawi.

Methods: This study involved offering CHCT and CFP services to couples in their homes; 180 couples were sampled from households in a peri-urban area of Blantyre. Baseline data were collected from both partners and follow-up data were collected one week later. A pair of counselors approached each partner separately about HIV testing and counseling and contraceptive services and then, if both consented, CHCT and CFP services were given. Associations between individual partner characteristics and acceptance of the services were examined with bivariate and multivariate analyses. Selected behaviors reported pre- and post-intervention, particularly couple reports on contraceptive use and condom use at last sex, were also analyzed.

Results: 89% of couples accepted at least one of the services (58% CHCT-only, 29% CHCT+CFP, 2% CFP-only). Among women, prior testing experience (p<0.05), parity (p<0.01), and emotional closeness to partner (p<0.01) had significant bivariate associations with acceptance of at least one service. Reported condom use at last sex increased from 6% to 25% among couples receiving any intervention. First-ever HIV testing was delivered to 25 women and 69 men, resulting, respectively, in 4 and 11 newly detected infections.

Conclusions: This study supports further research and testing of home- and couple-based approaches to expand access to HCT and contraceptive services to prevent the undesired consequences of sexually transmitted infection and unintended pregnancy through unprotected sex.

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RUNNING HEAD: Home-based Couples' HCT and Family Planning

INTRODUCTION

Two common elements of reproduction and heterosexual HIV transmission are that they involve both men and women and they occur in the context of sexual partnerships. Partnership contexts are critical to the explanation of pregnancy and HIV risk behaviors, and the dynamics of sexual partnerships need to be better understood. While some studies have shown that linking HIV to other reproductive health outcomes can increase the number of male clients reached, improve uptake of HIV counseling and testing (HCT), and condom use; the evidence is not always consistent.[1,2] Experimental studies in Ethiopia and China have shown higher rates of contraceptive acceptance and continuation and lower pregnancy rates (China) when both husbands and wives are counseled, compared to only one partner.[3,4] However, a recent review of six high quality couples-based HIV intervention studies indicate that couples interventions are in their infancy and should be conceptually grounded in an understanding of the structure and processes of couple relations that affect sexual risk behaviors, such as communication, power dynamics, intimacy, and fidelity.[5]

In sub-Saharan Africa a large proportion of HIV infections occur within the context of stable relationships either as a result of previous infection or infidelity.[6,7] De Walque reports that in five African countries, two-thirds or more of couples with at least one HIV-infected partner were serodiscordant.[8] Anglewicz and colleagues show that Malawian spouses are largely unable to assess each others' and their own level of HIV risk.[9]

Formative research in Botswana comparing couple HCT (CHCT) to individual HCT finds that most participants preferred the former. However, participants warned that couples interventions must be carefully planned and implemented to avoid blame, misunderstanding, mistrust and violence[10]. Larsson and colleagues find similar concerns about mistrust arising among men regarding CHCT during antenatal care in eastern Uganda.[11] The men discussed barriers to accessing CHCT which included the possibility of marital conflict, confusion about accessing care when they did not experience symptoms, and stigmatizing behaviors of health workers. Other studies show that influential people in the community or community health workers can positively promote CHCT uptake.[12,13] Randomized and observational studies find couples receiving CHCT show greater subsequent use of preventive measures, including condoms and nevirapine to prevent maternal to child transmission, than those receiving individual HCT.[14-19] A CHCT-HCT comparison study in Lusaka and Kigali found reduced loss to follow-up for those receiving CHCT and there is greater cost-effectiveness for CHCT.[20,21]

A Cochrane review found home-based HIV testing leads to higher uptake than clinic-based testing.[22] In an island community of Malawi, Helleringer showed high uptake of HIV home-delivered testing and counseling.[23] Allen and colleagues examined factors associated with acceptance of CHCT in Zambia and Rwanda and found that invitations for CHCT occurring in a discreet location and involving both members of a couple were associated with increased acceptance.[12]

Matovu and Makumbi reviewed about a dozen studies of home-based HCT and noted a number of benefits including elimination of the transportation costs, reduction of barriers associated with male dominance and need for permission, and reduction of stigma.[24] Studies in Asia and Africa have demonstrated the benefits of home-based delivery of contraception.[25-27] Studies in Uganda have detailed the benefits of home-based HCT. One study found door-to door HCT to be the most cost-effective per client tested as compared to

stand alone HCT, hospital-based HCT and HCT for other members in households with an HIV-positive individual.[28] Another Ugandan study compared home and clinic-based testing and randomized household members on ART to these interventions. Home-based HCT was associated with lower HIV prevalence, higher uptake, and increased identification of HIV-infected persons than the clinic-based intervention.[29] A mixed methods evaluation of a home-based HCT intervention in Uganda found it to be acceptable and effective--uptake of test results increased significantly as compared to clinic samples.[30] The qualitative portion of the study found that home-based HCT was also preferred because it reduced stigmatization and vulnerability associated with receiving results in public places.

The primary aim of this study is to estimate the uptake of CHCT and couple family planning (CFP) services delivered to *couples* in their *homes* in a single visit. To our knowledge, this combined approach has not been tested. We estimate the acceptance rates, examine factors associated with acceptance, and assess key behavioral outcomes (change in condom use at last sex and contraceptive use, first time diagnosis and visit to the clinic for HIV-positive persons) one week following the delivery of services to couples.

METHODS

The study site is Mpemba, a peri-urban area of Blantyre, Malawi. Mpemba lies within the catchment area of Queen Elizabeth Central Hospital (QECH), one of the country's main tertiary hospitals. Prior to the study, project staff met with community leaders to explain the purpose of the research. These meetings and a qualitative study in the same area confirmed that community members welcomed receiving home-based delivery of CHCT and CFP.[31]

Three villages within Mpemba were selected and a household listing was undertaken in September 2009 to identify those with eligible couples. An eligible couple was defined as a man-woman pair married or in union with the woman aged 15 to 49 years and the man 15 years or older. Additionally, both partners had to co-reside in the household at least one day each week and claim the household as "home". If there was more than one eligible couple in a household, only one was recruited to participate--the first couple available. If more than one couple was available, the most senior couple was selected. Polygamous men with co-resident wives were not included.

A study sample size of 180 couples was determined; this number provides estimates of proportions with a 95% confidence interval whose width (4*SE) is 0.15 (e.g., 50% ± 7.5%). Absent *a priori* data, we estimated that up to 50% of eligible couples would choose not to participate, requiring that at least 360 eligible couples be identified. We listed occupants of a total of 729 households in the three villages and identified 390 couples therein. The counselors ended enrollment after 180 couples were available to participate. All eligible couples in one village and about a third of them in the other two villages were approached. If one member of a couple was not available, repeated attempts were made to reach the couple at a time where they were both available. The numbers of listed households in the three villages were 74, 393 and 262 and the numbers of households with couples approached were 37, 79 and 64 respectively. Since many households did not have eligible couples and since enrollment was stopped after 180 couples were included, we have not calculated response rates from these figures.

The study protocol was approved by the Research Ethics Committee of the University of Malawi's College of Medicine and the Committee on Human Research of the Johns Hopkins School of Public Health.

Description of CHCT and CFP Home-Based Services Intervention

A pair of male and female counselors visited each couple. All counselors received intensive training in CHCT and CFP for five days, and each team had a qualified phlebotomist. After introducing themselves to both partners and providing an overview of the study, the counselors asked to meet privately with each partner and consented him/her to a baseline interview. The instrument included questions on marriage/union duration; schooling level; parity; current pregnancy; current use of contraception; desire for additional children; condom use at last sex with the partner; other sex partners in the last week; ever experience of physical violence from the partner; and ever tested for HIV. The instrument also included two attitudinal questions: "How emotionally close do you feel to your partner/spouse on a scale from 1 to 10, where 1 means no emotional closeness and 10 means very strong emotional closeness?" and "If you were to find out today that you/your partner were pregnant, how would you feel on a scale from 1 to 5, where a 1 means that you would be very unhappy to have a child now and a 5 means that you would be very happy to have a child now?"

After the baseline questionnaire, the woman's counselor sought a private location and asked her consent to CHCT+CFP, CHCT-only or CFP-only. That counselor then used color-coded cards to discreetly relay the woman's accepted intervention(s) to the male partner's counselor in a second private location (often outside the back of the house). The man was offered whichever service(s) the woman had accepted. If the woman accepted neither, the man was not offered any of the services and the session ended. If the man declined the service(s) accepted by the woman, both were individually informed they were not eligible for the study and also given referral cards for QECH services. Without regard to which, if any, services were accepted, all couples received referrals to QECH for family planning services, HIV testing, and domestic violence counseling should such be desired. These procedures were followed to protect the woman from possible coercion or other negative consequences.

For those who consented to both CHCT and CFP, the counselors reviewed the details of the interventions with each partner individually and then again as a couple, i.e., they would receive pre-test counseling together, individually have a rapid HIV test, and then receive CFP and condoms in the 20-40 minutes while awaiting test results. Pills and a re-supply of Depo-Provera could be provided but services for other contraceptive methods were by referral.

The rapid HIV tests followed national standards; Determine and Unigold rapid tests were administered in parallel. Determine's sensitivity on whole blood samples has been estimated at 100% and specificity at 96.2% and above.[32] Unigold has sensitivity estimated at 100% and specificity estimated at 99.7%.[33] A third rapid test, Ora-Quick, was available as a tie-breaker; however, it was not needed as there were no ties.

Test results were first provided individually and confidentially. During post-test counseling each partner confirmed his/her willingness to disclose results to the partner. For those who consented to sharing results, the counselors brought the couple back together and provided the appropriate post-test counseling -- this included the importance of mutual support, staying healthy through good nutrition, practicing protective behaviors including condom use, and mitigating any risk of marital discord. A follow-up visit was scheduled for one week later.

If either partner changed his/her mind about disclosure, then after post-test counseling individually, the couple was brought together for generic HIV counseling covering the four possible scenarios: both HIV-positive, both HIV-negative and discordance with either partner being HIV-positive. In couples with one or both partners HIV-positive, if counselors sensed a tense situation, they revisited the following morning to check on the couple's well-being. HIV-positive partners who disclosed were given transportation funds

to attend QECH for further testing and disease staging.

Counselors visited each couple a week later and at that time administered a brief follow-up questionnaire to each partner individually. Each was asked about a) sexual intercourse and condom use with the partner/spouse; b) sexual activity outside the partnership; c) physical violence from the partner; d) discussion with the partner about the HIV test and/or family planning counseling, and e) for HIV-positive persons, any follow-up visit to the referral clinic; f) current contraceptive use; and g) subjective feeling about finding out if the wife was pregnant and, during the past week.

Statistical Analyses

Proportions of couples accepting the services were calculated. Means for interval variables and percentages for categorical variables were tabulated for couples in each of the acceptance groups and ANOVA and chi-square tests done to detect differences between groups. Factors associated with couple acceptance of CHCT and/or CFP were assessed using multivariate logistic regression. Since the size of the couple sample was small and the number of potential covariates large, we used a stepwise forward procedure with an entry probability of 0.05.[34] We also examined couple concordance both pre and post-intervention on condom use at last sex and contraceptive use. We used McNemar's chi-square tests since the same couples were interviewed at two time points.

RESULTS

Figure 1 is a flow diagram for the study. Out of the 180 couples approached, 13 declined to participate in the baseline survey. Of the 167 couples offered CHCT+CFP services, 48 (29%) accepted the combined service intervention; 97 (58%) consented to CHCT only; 4 (2%) to CFP only and 18 (11%) declined any intervention (17 women declined and one man declined after the wife had accepted CHCT). The study

10

tested 145 couples for HIV, finding 14 (9.7%) concordant positive, 18 (12.4%) discordant (evenly divided between M+/F- and M-/F+), and 113 pairs concordant negative (77.9%). Among all the 149 couples accepting services, at least one member was successfully re-interviewed one week later--149 females and 140 males. (Nine males were not available at the follow-up visit.) No incidents of severe violence were reported at follow up.

Table 1 presents background characteristics of the study couples as a whole and by accepted service. Considering all couples, men were about six years older than their partners, the percentages with any schooling were 88% for females and 90% for males, and the marriage was the first for about three quarters of partners. Over 65% of each sex reported using contraception at baseline. Male partners were significantly less likely than females to have been tested for HIV previously (55% and 81% respectively, p < 0.01). Negligible percentages reported having other sexual partners in the past week and reports of any physical violence ever from the partner were 20% for females and 8% for males.

Comparing across intervention groups by sex and based on ANOVA tests, emotional closeness and number of live births were significantly different for females in either intervention group versus the non-acceptance group (Table 1). There was also a pattern in reports of condom use at last coitus with the highest for those in the CHCT+CFP group (23% female and 21% male), lower in the CHCT-only group and lowest (6%) in the non-acceptor group. The difference in female and male partner reporting of being victims of domestic violence was greatest in the non-accepting group (17% for females and 0% for males) but not significant across groups for either sex.

The top panel of Table 2 provides the crude odds ratios (OR) and 95% confidence intervals (CI) for the association between background covariates and the likelihood of accepting any service (CHCT and/or

CFP). Only three covariates--parity, prior HIV test and emotional closeness--had statistically significant

bivariate associations with accepting a service and only for females. Couples in which females had

previously tested for HIV had the highest odds of intervention acceptance (OR=3.16, 95%CI=1.12-8.93).

The odds of couples accepting an intervention increased with each birth reported by the female (OR=1.70,

95%CI=1.19-2.43), and with each point gain in her emotional closeness score (OR=1.42, 95%CI=1.15-

1.74).

Before multivariate analyses were conducted, we checked for nonlinear effects of parity and emotional

closeness by considering 3 categories for each. There was not a significant trend for emotional closeness

but there was for parity. A squared term was therefore added in the stepwise regression. The multivariate

model results are shown in the bottom panel of Table 2. Parity (squared) is significantly associated with

intervention acceptance (adjusted odds ratio [AOR]=1.14, 95%CI=1.03-1.26), as is emotional closeness

(AOR=1.48, 95%CI=1.18-1.85) but prior HIV test loses significance.

The couple- and home-based intervention delivered HCT services to many for the first time. There were

32 untested women and 76 untested men in the 167 couples at baseline (middle column panel and middle

row panel respectively of Table 3) Of these, 78% of women and 91% of men received their first HIV test,

with 4 women (16%) and 11 men (14%) learning their HIV-positive status; two of these were sero-

concordant HIV-positive couples.   More than half of all individuals testing positive went to the clinic for

referral services.

From re-interviews one week later, in about three-fifths of couples tested, both partners reported discussing

last week's HIV test (Table 4) with 12% saying it was for the first time. Among HIV-positive participants

(n=45), over half (57% of females and 55% of males) reported going to the clinic for follow-up care in the previous week (not shown).

Concordant positive reports on both condom use at last sex in the week since the intervention and contraceptive use increased relative to baseline levels in both intervention groups (Table 5).   Reported condom use at last sex increased from 6% to 25% among couples receiving any intervention. Contraceptive use increased most in the CHCT+CFP intervention group.

DISCUSSION

This pilot study has some limitations. First, the sample size is small so only large differences could be detected as statistically significant; however as planned we could estimate that the percentage accepting one or both services in this population lies in the interval 83% ± 5% with 95% confidence. Second, there was no control group, as it was designed as a pilot study to assess feasibility. However, first-time testing and newly detected HIV infections show that in the absence of the intervention 11 men and 4 women would not have known they were infected. Third, social desirability bias could distort the findings, particularly since the same counselors visited one week later to administer the post-intervention questionnaire. We adopted this approach because the counselors had established some rapport with participants the previous week and, in the interests of human subjects' protection, they were better positioned to deal with any problems arising in the couple. The risk of social desirability bias is mitigated somewhat since the follow-up responses come from interviews with each partner independently and only concordant reports are given as results.

Our study found that a large majority (83%) of couples in peri-urban Malawi accepted home-based family

planning and/or HCT services. Their acceptance of HCT in the home is consistent with the literature cited above. Research in Uganda found discussion about and negotiation of sexual relations to be the greatest challenge for members of discordant partnerships.[35] CHCT/CFP interventions can improve couple communication surrounding sexual and reproductive health, as has been found in multiple settings.[36] The low acceptance of the CFP component may be because of high contraceptive use already due to an active private family planning program in the area.

HIV counseling and testing is one pillar of strategies to prevent transmission. Despite the availability of free testing at health facilities close to the study area, a large percentage of male partners had never been tested. The piloted intervention delivered HCT services accepted by 78% and 91% of female and male partners respectively, and reported use of condoms also increased substantially after the counseling visit.

The likelihood of a couple's acceptance of services was positively and significantly associated with a woman's number of live births, reported emotional closeness to her partner, and prior HIV-testing. Male covariates were not significant in predicting acceptance, possibly because males were only offered the services that their partners first accepted. In 17 of the 18 cases it was the woman who declined services.

Home-based CHCT and CFP warrant further study and any scale-up will invoke operational considerations. First, the combined approach should be tested using an experimental design. Second, the costs and cost-effectiveness of integrated home-delivery services should be tracked and assessed. The level of start-up costs will depend not only on the country setting but also on client load for community-level workers. From this pilot study, the ratios of intervention costs to three HIV-related outcomes -- tested, newly tested, and testing positive were $104, $321, and $656 per individual respectively. Third, protocols need to be developed for sites where polygamous men have co-resident wives. Fourth, this pilot

study had stopping rules in place in case of serious violence, but no incidents were reported in the week post-intervention. However, in two incidents suggesting marital discord, two husbands, upon learning of their HIV infection, told counselors they felt they should leave the marital home and not infect their wives. The counselors dissuaded them from leaving.

Semrau and colleagues have reported that couple counseling in Zambia did not increase the incidence of adverse events over individual counseling.[37] Though earlier studies documented violence associated with HIV-status disclosure of HIV-positive women to their partners, a literature review of CHCT interventions indicated no additional risk associated with disclosing results to a partner.[38,39,6] In general, CHCT services need to protect male as well as female partners from potential negative relationship consequences.

The findings from this pilot study support further research and testing of home- and couple-based approaches to prevent the undesired consequences of unintended pregnancy and sexually transmitted infection through unprotected sex in Malawi and elsewhere in Africa. The approach enabled first-time HIV testing with men, detected new infections among men and women, and facilitated couple-level discussion around sexual and reproductive risk behaviors.

Table 1: Means and percentages of background characteristics of study couples by partner sex and intervention accepted

Characteristic	Intervention accepted and sex (%) [a]							
	All study couples		CHCT and CFP		CHCT only		None	
	n=167		n=48		n=97		n=18	
	Female	Male	Female	Male	Female	Male	Female	Male
Means								
Age (years)	28.3	34.8	27.5	33.6	29.0	35.7	25.3	31.3
Duration of union (years)	8.9	9.1	9.4	9.8	8.9	9.3	6.8	7.6
Number of live births	3.4*	3.4	3.5	3.4	3.5	3.5	1.8	2.3
Emotional closeness to partner score[b]	8.3*	8.6	8.5	8.7	8.4	8.6	6.7	8.1
Percentages								
In first union	77	72	81	73	71	71	94	78
With any schooling	88	90	90	94	87	90	94	89
Unhappy if discovered pregnant now	71	71	79	81	71	70	53	60
Using contraception	66	65	60	60	70	68	56	56
Reporting condom used at last coitus with partner	15	15	23	21	12	19	6	6
Reporting ever had HIV test	81*	55	88	46	80	56	61	67
Reporting other sex partner in last week	1	2	0	2	2	2	0	0
Reporting ever any violence from partner	20	8	15	6	24	10	17	0

[a] 4 couples accepting CFP only are not shown separately; [b] 1= no emotional closeness … 10 = very strong emotional closeness
* p<0.05 for test of hypotheses of equal percentages in each intervention group for a given sex

Table 2. Estimated odds ratios (and 95% confidence intervals) for selected covariates from
logistic regressions of couple acceptance of CHCT and/or CFP by sex (149 couples accepting,
18 not accepting)

Covariate	Sex	
	Female	Male
Bivariate models		
Age in years	1.07 (0.99-1.15)	1.05 (0.99-1.11)
Any schooling (No schooling = reference)	0.40 (0.50-3.20)	1.20 (0.25-5.79)
Duration of union in years (averaged)	1.04 (0.97-1.13)	
Number of live births	1.70 (1.19-2.43)	1.29 (1.00-1.69)
Condom used at last sex with partner (No= reference)	3.26 (0.41-25.70)	3.43 (0.44-26.95)
Unhappy if learned now pregnant (Ambivalent or happy = reference)	1.77 (0.78-4.01)	0.84 (0.42-1.68)
Emotional closeness score	1.42 (1.15-1.74)	1.20 (0.92-1.57)
Had prior HIV test (No test = reference)	3.16 (1.12-8.93)	0.56 (0.20-1.58)
Current use of contraception (Not using = reference)	1.63 (0.61-4.40)	1.54 (0.57-4.13)
Ever physically violent with partner (no violence = reference)	1.31 (0.36-4.83)	*
Multivariate model (forward stepwise)	Adjusted odds ratios (95% CI)	
Number of live births squared	1.14 (1.03-1.26)	
Emotional closeness	1.48 (1.18-1.85)	

* Not estimable; all males reporting partner violence accepted an intervention.

Table 3: Percentage of partners in couples at one week follow-up with positive concordant reports of specific behaviors since the counseling visit, by intervention accepted

Behavior	Intervention accepted (%/N)		
	All interventions	CHCT+CFP	CHCT only
Coitus in last week	74 (140)[a]	67(46)	48 (90)
Talked with partner about HIV testing	63 (136)	65(46)	61(90)
First time talked with partner about HIV testing	12(85)	7 (30)	15(55)
Talked with partner about FP counseling	41(140)[a]	57(46)	33(90)
First time talked with partner about FP	11 (57)	4 (26)	17 (30)

[a] Including 4 couples who accepted CFP only.

Table 4: Percentage of couples with positive concordance on family planning use and condom use at last sex, pre and post intervention by intervention accepted

Measure/Acceptance group (n)	Pre	Post	One week Change[a] (95% CI)
Using family planning			
All interventions (140)[b]	61	73	+12 (5,18)
CHCT only (90)	63	69	+6 (-1,12)
CHCT & CFP (46)	57	80	+24 (11,37)
Using condom at last sex[c]			
All interventions (102)	6	25	+19 (9,28)
CHCT only (71)	3	23	+20 (9,30)
CHCT & CFP (31)	13	29	+16 (0,35)

[a] This figure may be off by 1% from the difference of pre and post levels, due to rounding.

[b] Including 4 couples in family planning-only group.

[c] For the follow-up this question refers to coitus in the past week so only those who reported coitus are included and these couples are subset from all the couples responding in the baseline.

REFERENCES

1. Church S, Mayhew KS. Integration of STI and HIV prevention, care and treatment into family planning services: A review of the literature. *Studies in Family Planning*. 2009;40:171-186.

2. Spaulding A, Brickley D, Kennedy C, et al. Linking family planning with HIV/AIDS interventions: A systematic review of the evidence*. AIDS,* 2009;23:S79-88.

3. Terefe A and Larson C. Modern contraception use in Ethiopia: Does involving husbands make a difference? *American Journal of Public Health.* 1993;83:1567-1571.

4. Wang C, Vittinghoff E, Hua, LS, et al. Reducing pregnancy and induced abortion in China: Family planning with husband participation. *American Journal of Public Health.* 1998;88:646-8

5. Burton J, Darbes L, Operario D. Couples-focused behavioral interventions for prevention of HIV: Systematic review of the state of evidence. *AIDS Behavior.* 2010;14:1-10.

6. Desgrees-du-Lou A. Orne-Gliemann J. Couple-centered testing and counseling for HIV serodiscordant heterosexual couples in sub-Saharan Africa. *Reproductive Health Matters.* 2008;16:151-161.

7. Dunkle K, Stephenson R, Karita E, et al. New heterosexually transmitted HIV infections in married or cohabiting couples in urban Zambia and Rwanda: an analysis of survey and clinical data. *Lancet.* 2008;371:2183-2191.

8. de Walque D. Sero-discordant couples in five African countries: Implications for prevention strategies. *Population and Development Review*. 2007;33:501-523.

9. Anglewicz P, Assche S, Clark S, et al. HIV risk among currently married couples in rural Malawi: What do spouses know about eachother? *AIDS Behavior.* 2010;14:103-112.

10. Kebaabetswe P, Ndase P, Mujugira A, et al. Perceptions of couple HIV counseling and testing in Botswana: A stakeholder analysis. *Patient education and counseling.* 2009;79:120-123.

11. Larsson E, Thorson A, Nsabagasani X, et al. Mistrust in marriage- Reasons why men do not accept couple HIV testing during antenatal care- a qualitative study in eastern Uganda. *BMC Public Health.* 2010;10:769.

12. Allen S, Karita E, Chomba E, et al. Promotion of couples' voluntary counseling and testing for HIV through influential networks in two African capital cities. *BMC Public Health.* 2007;7:349.

13. Chomba E, Allen S, Kanweka W, et al. Evolution of couples' voluntary counseling and testing for HIV in Lusaka, Zambia. *Acquired Immune Deficiency Syndrome.* 2007;47(1):108-115.

14. Allen S, Tice J, Van De Perre P, et al. Effect of serotesting with counselling on condom use and seroconversion among HIV discordant couples in Africa. *British Medical Journal.* 1992;304:1605-1609.

15. Farquhar C, Kiarie J, Richardson B, et al. Antenatal couple counseling increases uptake of interventions to prevent HIV-1 transmission. *Journal of Acquired Immune Deficiency Syndromes.* 2004;37:1620-1626.

16. Kamenga M, Ryder R, Jingu M, et al. Evidence of marked sexual behavior change associated with low HIV-1 seroconversion in 149 married couples with discordant HIV-1 serostatus: Experience at an HIV counselling center in Zaire. *AIDS* 1991;5:61-67.

17. The Voluntary HIV-1 Counseling and Testing Efficacy Study Group. Efficacy of voluntary HIV-1 counselling and testing in individuals and couples in Kenya, Tanzania, and Trinidad: a randomized trial. *Lancet.* 2000;356:103-112.

18. Becker S, Mlay R, Schwandt H, et al.   Comparing couples' and individual voluntary counseling and testing for HIV at antenatal clinics in Tanzania: A randomized trial. *AIDS Behavior.* 2009;14:558-66.

19. Conkling M, Shutes E, Karita E, et al. Couples' voluntary counseling and testing and nevarapine use in antenatal clinics in two African capitals; a prospective cohort study. *Journal of the International AIDS Society.* 2010;13:10.

20. John F, Farquhar C, Kiarie J, et al.   Cost-effectiveness of couple counseling to enhance infant HIV-1 prevention. *International Journal of STD and AIDS.* 2008;19(6):406-409.

21. Sweat M, O'Reilly K, Schmid G, et al. Cost-effectiveness of voluntary HIV-1 counseling and testing in reducing sexual transmission of HIV-1 in Kenya and Tanzania. *Lancet. 2000;* 356:113-21.

22. Bateganya M, Abdulwadud O, Kiene S. Home-based HIV voluntary counseling and testing in developing countries. *Cochrane Database of Systematic Reviews.* 2007.

23. Helleringer S, Kohler H, Frimpong J, et al.   Increasing uptake of HIV testing and counseling among the poorest in sub-Saharan countries through home-based service provision. *Journal of Acquired Immune Deficiency Syndromes.* 2009;51:185-193.

24. Matovu J, Makumbi F. Expanding access to voluntary HIV counseling and testing in sub-Saharan Africa: alternative approaches for improving uptake, 2001-2007. *Tropical Medicine and International Health.* 2007;12:1315-1322.

25. Phillips J, Bawah A, Binka F. Accelerating reproductive and child health programme impact with community-based services: The Navrongo experiment in Ghana. *Bulletin of the World Health Organization.* 2006;84:949-955.

26. Daniel E, Masilamni R, Rahman M. The effect of community-based reproductive health communication interventions on contraceptive use among young married couples in Bihar, India. *International Family Planning Perspectives*. 2008;34:189-97.

27. Prata N, Vahidnia F, Potts M, et al. Revisiting community-based distribution programs: Are they still needed? *Contraception.* 2005;72:402-407.

28. Menzies N, Abang B, Wanyenze R, et al. The costs and effectiveness of four HIV counseling and testing strategies in Uganda. *AIDS.* 2009;23:395-401.

29. Lugada E, Levin J, Abang B, et al. Comparison of home and clinic-based HIV testing among household members of persons taking antiretroviral therapy in Uganda: Results from a randomized trial. *Acquired Immunodeficiency Syndromes*, 2010;55(2):245-252.

30. Wolff B, Nyanzi B, Katongole G, et al. Evaluation of a home-based voluntary counselling and testing intervention in rural Uganda. *Health Policy and Planning.* 2005;20(2):109-116.

31. Gipson JD, Muntifering CJ. Chauwa FK, et al. Assessing the importance of gender roles in couples' home-based sexual health services in Malawi *Afr J of Reprod Health* 2010;14: 63-73.

32. Branson B. State of the art for diagnosis of HIV infection. *CID,* 2007;45(Suppl 4):S221-225.

33. Palmer C, Dubon J, Koenig E. et al. Field evaluation of the Determine rapid Human Immunodeficiency Virus diagnostic test in Honduras and the Dominican Republic. *Journal of Clinical Microbiology.* 1999;37:3698-3700.

34. STATACorp Stata Statistical Software. Release 9, College Station, TX. *2005.*

35. Bunnell R.E, Nassozi J, Marum E, et al. Living with discordance: knowledge, challenges, and prevention strategies of HIV-discordant couples in Uganda. *AIDS Care*. 2005;17:999-1012.

36. Orne-Gliemann J, Tchendjou P, Miric M, et al. Couple-oriented prenatal HIV counseling for HIV primary prevention: an acceptability study. *BMC Public Health.* 2010;10:197.

37. Semrau K, Kuhn L, Vwalika C, et al. Women in couples antenatal HIV counseling and testing are not more likely to report adverse social events. *AIDS.* 2005;19:603-609.

38. Temmerman M. Indinya-Achola J, Ambani J, et al. "The right not to know HIV-test results." The Lancet. 1995;345:969-970

39. Medley A, Garcia-Moreno C, McGill S, et al. Rates, barriers and outcomes of HIV serostatus disclosure among women in developing countries: implications for prevention of mother-to-child transmission programmes. *Bulletin of the World Health Organization, 2004;82*:299-307.