Do Free Condoms Increase Self Reported Rates of Condom Use in HIV positive Clients?

A Pilot Study

Quality Health Partners and the National AIDS and STI Control Programme – Ghana Health Service

Quality Health Partners is a bilateral assistance project funded by USAID/Ghana and led by EngenderHealth. Jhpiego and Abt Associates are implementing partners on the project. Technical assistance is also provided by Initiatives, Inc. and Family Health International.

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Suggested Citation: Quality Health Partners and the National AIDS and STI Control Programme – Ghana Health Service (2009). Do Free Condoms Increase Self-Reported Rates of Condom Use in HIV Positive Clients? A Pilot Study. (Accra, Ghana: Quality Health Partners).

This publication was made possible by support from USAID/Ghana under the terms of Cooperative Agreement 641-A-00-04-00232. The opinions expressed are those of the authors and do not necessarily reflect the views of USAID.

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Acronyms and Abbreviations

ART	Antiretroviral therapy
JSS	Junior Secondary School
MSLC	Middle School Leaving Certificate
NACP	National AIDS/STI Control Programme
PLWHA	People living with HIV and AIDS
QHP	Quality Health Partners (project of USAID/Ghana)
SSS	Senior Secondary School
STI	Sexually transmitted infection
USAID	U.S. Agency for International Development

Acknowledgments

This study could not have been accomplished without the contributions of many individuals, financial support of USAID/Ghana and the organizational support of the Ghana Health Service. QHP wishes to thank USAID/Ghana and the American people for their generous financial support and for their shared commitment to help the Government of Ghana and the Ghanaian people to improve the quality of health services and the health status of Ghanaians.

QHP is grateful to the National AIDS and STI Control Program (NACP) of the Ghana Health Service for their collaboration generally and for their partnership in undertaking this pilot study. Special thanks to the Project Manager, Dr. Nii Akwei Addo who served as the Principal Investigator and provided support throughout the period of the study. Thanks also to the Facility Heads as well as the Coordinators and staff of the HIV Units of the study sites, namely; Korle Bu Teaching hospital, Ridge Hospital, Police Hospital, Koforidua Regional Hospital, Atua Government Hospital and Tema General Hospital. To the Counselors and Models of Hope, Pharmacists who took on the additional tasks of providing extra counseling services on condom use, distributing and keeping records of the study activities, QHP is most grateful.

To Kerry Bruce (formerly of QHP) who initiated the concept for the study and developed the initial protocol, QHP is grateful. Thanks also go to Abigail Donner (formerly a QHP intern and a MSc Candidate of Harvard School of Public Health) and the other EngenderHealth staff who worked to review and modify the protocol and data collection tools. The EngenderHealth staff are Melinda Pavin (EngenderHealth/NY), Richard Killian, Edward Bonku, Angela Bannerman, Olivia Aglah and Peter Preko (formerly of QHP). Special thanks also to Angela Bannerman and Elizabeth Hammah who coordinated the entire study at the field level.

QHP is also grateful to the following who took part in data collection; Nathaniel Coompson, Harriet Charway and Rita Sackitey of the Korle Bu Teaching Hospital; Adelaide Amoako, Franklin Apkokli and Samuel Addo (formely of Korle Bu Teaching Hospital), Becky Spensor of the Planned Parenthood Assoc. of Ghana and Juliana Seffa of Adabraka Polyclinic.

Finally, QHP is also grateful to Caroline Grogan, the Consultant who wrote the report. Richard Killian, Kerry Bruce and Angela Bannerman edited and reviewed the report.

Do Free Condoms Increase Self-Reported Rates of Condom Use in HIV Positive Clients? A Pilot Study

ABSTRACT

Introduction: The endline data analysis for this study examining the feasibility and impact of routine condom provision to ART clients in Ghana has two objectives. The first is to compare rates of self-reported condom use among HIV positive clients who receive free condoms when accessing clinical care with rates of self-reported condom use among HIV positive clients accessing clinical care in facilities where condoms are not provided to clients for free. The second is to estimate the number of infections averted through increased condom use – as a result of both health education sessions and free condom distributions.

Methods: This cross-sectional comparative study gauges changes in clients' reported use of condoms during a one-year period in intervention and control sites. The intervention sites are health facilities where free condoms are distributed to clients. The control sites are health facilities where only condom education is offered and clients are able to purchase condoms at the facility or elsewhere. In three of the four intervention sites, health education on the correct use of condoms will be provided in addition to free condoms. In the fourth intervention site, only free condoms will be distributed. Baseline interviews were conducted at the start of the intervention in June, 2008 and midterm interviews took place in November, 2008. Final interviews took place in June, 2009. Using the data from the baseline, midterm and final interviews, chi square tests were conducted to show whether condom use increased over time and whether respondents exposed to the interventions were more likely to report condom use at last sex. A logistic regression examined which factors, including being exposed to the intervention, were correlated with reporting condom use in the endterm data. To estimate the number of infections averted by the intervention, the analysis used the Bernoulli-Process model of HIV transmission.

Results: At endline, clients who reported being exposed to the intervention (receiving free condoms, receiving condom counseling, or receiving both, depending on the trial arm) were significantly more likely to report condom use at last sex than clients who did not report being exposed to the intervention in both the condom only (Pr=0.003) and health education and condom facilities (Pr<0.001). The regression model showed that being exposed to either intervention where free condoms were provided was associated with a 297% increase in the odds of using a condom at last sex compared to people who were not exposed, suggesting that the intervention significantly increases the log odds of using a condom at last sex. Other factors significantly associated with an increase in condom use at last sex were taking ARVs (OR=6.09), having sex in the last 30 days (OR=7.95), being age 40 to 46 (OR=4.21) and having no living children (OR=4.36). Factors associated with a decrease in the log odds of condom use were being married or cohabitating (OR=0.27), being diagnosed with HIV less than a year ago (OR=0.32), reporting no current sexual partner (OR=0.03), and reporting no partners in the last year (OR=0.07).

Conclusion: The analysis found that self-reported condom use among HIV positive clients (as measured by condom use at last sex) was higher among those who were exposed to free condom distribution over a one year period than among those who were not exposed to free condoms over the same period. (OR=3.97, p=0.001) Exposure to condom counseling without free condom distribution did not result in a significant increase in the number of clients reporting condom use at last sex. In the arm of the trial where health education and condom distribution were combined, approximately 12.53 infections were averted among partners of women and approximately 7.79 infections were averted among partners of men over the one year period. In the condom only intervention, 3.49 infections were averted among partners of women. Because reported condom use at last sex fell between the start and end of the study for men at the condom only facility, no infections were averted among their partners. In the Health Education only arm, 0.29 infections were averted among men; no infections were averted among women again because of a decrease in self-reported condom use.

INTRODUCTION

In the six years since the introduction of antiretroviral therapy (ART), AIDS has been transformed from a certain death sentence to a more manageable condition for thousands of Ghanaians. The Ghanaian public sector began providing ART in 2003, and by September 2007 it was available in 48 hospitals and clinics around the country with 11,543 people receiving treatment (Dzokoto 2008). One of the benefits of ART is that people living with HIV (PLWHA) who have access to the regular regimen of medicines begin to feel better, and therefore return to sexual activity. Some suggest that people receiving effective ART who do not have other genital infections cannot transmit the virus through sexual contact (Vernazza, Hirschel et al. 2008). However, others contend that a decreased viral load makes PLWHA only less likely to transmit HIV (Wilson, Law et al. 2008). Because this point has not been resolved, and because epidemiological models have shown that even small increases in risky behavior can outweigh the effect of ART on transmission rates and therefore lead to an increase in HIV prevalence, (Wilson, Law et al. 2008), it is important to equip ART clients with the information, skills, and tools necessary to minimize the risk of HIV transmission to their sexual partners.

Used correctly and consistently, condoms are among the most cost-effective approaches to preventing HIV and are significantly more cost effective than ART (Creese, Floyd et al. 2002). HIV positive clients, however, do not routinely receive counseling on condom use subsequent to their first HIV test in Ghana (Quality Health Partners 2007). In addition, even though low cost condoms are readily available throughout most parts of the country, condoms are not distributed or sold to HIV positive patients on a regular basis. This is a missed opportunity to combine prevention directly with treatment at a relatively low cost. Combining different successful approaches has been cited as a crucial element of an effective response to the HIV epidemic by experts on both sides of the debate about which prevention technologies are most effective (Merson, Padian et al. 2008; Halperin 2009). In addition, this attention to sexual activity responds to numerous calls in recent HIV literature for programs that address the sexual and reproductive health needs and rights of PLWHA (Gruskin, Ferguson et al. 2007).

The inspiration for the current pilot study comes from a social marketing campaign in Louisiana in which over 33 million condoms were made freely available throughout the state. Surveys among 275,000 African Americans showed that condom use subsequently increased by 30% (Bedimo, Pinkerton et al. 2002). In order to determine the feasibility and impact of routine condom distribution to ART clients in Ghana, Quality Health Partners, a USAID-funded reproductive and child health project, and the National AIDS and STI Control Program launched a pilot study in 2008. The study has two objectives:

> *Objective 1*: To compare rates of self-reported condom use among HIV positive clients who receive free condoms when accessing clinical care with rates of self-reported condom use among HIV positive clients accessing clinical care in facilities where condoms are for sale.
>
> *Objective 2*: To estimate the number of infections averted through increased condom use – both through health education sessions and through free condom distributions.

To achieve these objectives, the cross-sectional comparative study gauges changes in clients' reported use of condoms during a one-year period in intervention and control sites. The intervention sites are health facilities where free condoms are distributed to clients. The control sites are health facilities where only condom education is offered and clients are able to purchase condoms at the facility. The analysis of data gathered at these sites seeks to answer the question of whether free condom distribution does increase rates of self-reported condom use amongst HIV positive patients in Ghana. It also seeks to estimate the number of infections averted through the condom distribution program so that the impact of the program can be compared with other HIV prevention efforts currently ongoing in Ghana.

METHODS

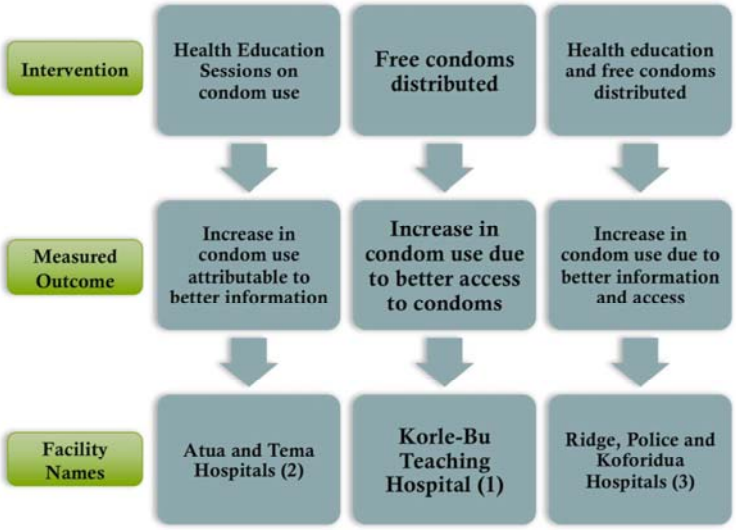
Study population

The study population consists of HIV positive men and women over age 18 who attend six ART clinics at hospitals in the Greater Accra and Eastern regions.

Figure 1 interventions and the outcomes measured

Study & sample design

The cross-sectional comparative study gauges changes in clients' reported use of condoms during a one-year period in intervention and control sites. The intervention sites were health facilities where free condoms were distributed to clients. The control sites were health facilities where only condom education was offered and clients were able to purchase condoms at the facility or elsewhere. In three of the four intervention sites, health education on the correct use of condoms was provided in addition to free condoms. In the fourth intervention site, only free condoms were distributed. Therefore the trial had three arms, facilities where clients received only condom education, facilities where the clients received only free condoms, and facilities where clients received both condom education and free condoms. See **Figure 1** for an illustration of the three arms.



At sites where condom education took place, the pharmacies, counselors or models of hope[1] were charged with ensuring that all clients receive 10 free condoms during each visit. Men received male condoms and were told that female condoms were also available. Female clients received one female condom and 10 male condoms and were told that more female condoms were available. Clients could request additional condoms at any time if desired. The condoms were procured through the Ghana Health Service Family Planning Unit and were the standard condoms available for sale in Family Planning facilities. Condoms were distributed in a plain bag. There were some missed opportunities in reaching out to as many clients with the intervention. Facilities that combined condom education with condom distribution (Police and Koforidua) initially gave condoms only to clients counseled instead of to all clients who visited for services. Again because of inaccurate reporting of stock levels some facilities run out of condoms for short periods along the way (Korle-Bu, Koforidua and Ridge). There was also an initial lack of commitment by some pharmacists who considered the additional task to be too much work to effectively distribute the condoms (Ridge). All of these were rectified in the course of the study. Condom distribution at Korle-Bu was done only by Models of Hope at Korle-Bu and they tended to be more conscientious in the distribution efforts.

At sites where health education took place, clinic staff who received special training on how to conduct condom education for the study held sessions on an ongoing basis, and presented sessions to clients as often as they had time, with the goal of reaching ten clients per clinic day, and everyone in clinical care within six months. Clinic staff were remunerated for this addition to their daily workload and monitored throughout the course of the study to ensure that counseling took place correctly and consistently. Sessions were held individually and in groups and

[1] Trained peer volunteers who undertake support activities related to counseling and clerical duties at ART clinics.

included demonstrations on the correct use of the male and female condom, the benefits of consistent condom use to prevent new infections, re-infections, unplanned pregnancies, STIs and the possible associated effect of new infections on drug resistance.

Client interviews were conducted at each site at baseline in June 2008, six months later at midterm, and again six months later in June 2009 for final follow up. The analysis in this paper focuses on the final data. Respondents were a random sample of clients from all six sites, selected by choosing every third person over the age of 18 as they arrived for care until the required sample size for the facility was reached. The patients interviewed at midterm and endterm were not necessarily the same patients that were interviewed at baseline. The sample size at each facility was based on the number receiving clinical care there and is presented in **Table 1**. The required sample size was calculated with the expectation that there would be a 20% increase in condom use in the intervention group over the non-intervention group. Because there were more than three times as many patients in the intervention facilities as the control facilities, the sample size was increased in the intervention facilities. 225 people were interviewed at baseline, 403 at midterm, and 570 people were interviewed at final follow up.

Survey instrument

The survey instrument collects information from respondents about their demographic characteristics, their attitudes about condoms and usage patterns, their recent sexual activity, and their opinions about and usage of the condoms they received for free.

Statistical methods

Descriptive Statistics
The demographic characteristics of the study population are presented through a series of frequency tables for the baseline, midterm, and final follow up data.

Chi Square Tests
The Millennium Development Goals have one sexual behavior indicator, which is condom use at last sex with a higher risk partner (Cleland, Boerma et al. 2004). Because all partnerships in this study are high risk, this study will focus on 'condom use at last sex' as the main indicator of self-reported condom use. This indicator has stood up well to scrutiny about its validity and reliability because anchoring condom use to a specific, recent event makes it less difficult to recall and less prone to social desirability bias (Cleland, Boerma et al. 2004). 'Condom use at last sex' is also a reasonable proxy for consistent use, because the two measures are highly correlated in cross sectional and prospective studies (Cleland, Boerma et al. 2004). One study found that the single-event recall period – last sex – was consistent with longer recall periods – 14 days and 60 days – suggesting that condom use at last sex is a valid proxy for condom use behavior over longer time periods (Younge, Salazar et al. 2008). Chi square tests were be conducted to determine whether there was an increase in the number of people reporting condom use at last sex between the launch, midterm, and conclusion of the intervention for all three trial arms. Because it is important to look specifically at the respondents who were exposed to the intervention rather than just those who were attending facilities where interventions were taking place, chi square tests are also used to look at the relationship between those who reported being exposed to the intervention and condom use at last sex.

Figure 2: Client Exposure to Intervention Strategy

Logistic Regression

A logistic regression is used to verify which factors, including being exposed to the intervention, are correlated with respondents reporting condom use. The regression models the probability of condom use at last sex – a binary outcome variable – as a function of the set of variables thought to possibly affect the response. The key question is whether participation in the intervention has affected whether respondents used a condom at last sex. Therefore, the primary predictors are the generated set of variables that show whether a respondent was exposed to the intervention. The regression analysis is conducted using the endline data, since the baseline data was collected before anyone was exposed to the interventions, and the midterm regression was conducted in a separate analysis. A respondent was considered exposed to the health education only intervention if he or she was interviewed at a facility designated for that specific intervention, and reported receiving counseling on condom use in the past six months. A respondent was considered exposed to the condom only intervention if he or she was interviewed at Korle-Bu (the only facility designated for the condom only intervention) and reported receiving free condoms at the facility in the past six months. And a respondent was considered exposed to the combined intervention if he or she was interviewed at one of the three hospitals where the combined intervention was taking place and reported receiving free condoms AND reported receiving counseling on condom use at the facility within the last six months. Please see **Figure 2.**

In addition to which intervention respondents were exposed, age, gender, education and marital status are potential covariates because past studies have found them to be significant predictors of condom use. Whether someone is trying to have a child and whether they are on ARVs is also considered since significant results could have policy implications, such as how to appropriately target health education. For the same reason, number of living children, number of sex partners, diagnosis timing, type of sexual partners, whether a patient has disclosed their status to their partner, and time since sexual intercourse are also candidate covariates. Whether a respondent's partner is HIV positive is also included to determine whether the intervention has a differential impact on seroconcordant or serodiscordant partnerships. Facilities are not included separately since the condom only intervention took place at just one hospital and therefore the intervention variable cannot be distinguished from the facility variable. Variables related to condom use are not included to reduce the likelihood of collinearity - false negatives that result because related variables overlap or compete. To conduct the regression, the following steps were followed:

1. The frequencies of each predictor were examined to decide whether and how to collapse categories and create categories to increase the power of the tests. Continuous predictors were examined to see if linear relationships with the outcome were reasonable, and otherwise were treated as ordinal. Ordinal predictors were only treated as continuous if a significant trend test demonstrates that an assumption of linearity could be justified. Frequency tables also helped clarify if a non-convergence problem existed. Non-convergence occurs when one sub-group of a binary covariate has no events and therefore no maximum likelihood estimates and the logistic model fails to converge. Any observations where the outcome variable was missing were eliminated, even though this resulting drop in sample size results in less power and less generalizability. For other covariates the sample size was left to float so as to maximize power and minimize bias for each analysis.

2. Univariate tests were run between each predictor and the outcome variable. Any covariate that had a p value of 0.2 or less was a candidate for inclusion in the model.

3. Using the candidate predictors established by univariate tests and the inclusion rule, a forward selection automated procedure was run. This process is strongly protective against false negatives (predictors losing significance) due to collinearity.

4. The multivariate test was compared with the univariate results to check for confounding. First, variables eliminated during the forward selection process were added back into the model one by one, starting with the

variable with the smallest univariate p value. With each addition, the model was re-run to assess changes in betas and p-values. If the beta-coefficient increased or decreased by 10% or greater, the variable was permanently added back into the model prior to testing further covariates for confounding.

5. Non-significant but necessary variables were examined. Because intervention exposure is the primary predictor of interest, it was included in the model regardless of significance.

6. Terms that may have overfit the model were examined for removal. Based on the rule that the number of variables in the model should not exceed the number of outcome events or non-events (whichever is smaller) divided by ten, the number of variables in the model was limited to 24 to ensure stability. This is because there were 278 events – condom use at last sex – and 248 non-events – no condom use. 248 divided by ten, or 24 is the smaller of the two numbers.

7. Continuous variables were checked to ensure they were used appropriately by checking beta coefficient step size. To accomplish this, the continuous predictors were divided into at least four equal width bins to ensure that the sample size for each bin was large enough, and there were successes in each bin. The semi-final model was run with these variables to see whether the inclusion of the covariates created or solved a non-linearity problem. If the betas were roughly equal in step size, the continuous predictors were used without changes. If not, the continuous predictors were converted into categorical variables. They were not transformed to avoid problems of interpretability.

8. To confirm how well the model fits the data, a goodness-of-fit test was performed. The Hosmer-Lemenshow test determined how well the model fits the data.

Estimate of Infections Averted

To estimate the number of infections averted, the analysis followed the Bernoulli-Process model of HIV transmission, which was successfully used by Bedimo et al to estimate the number of HIV infections averted during a free condom distribution to the public in the US (Bedimo, Pinkerton et al. 2002). The model has been used in several other studies, and an empirical evaluation conducted in Africa indicated good agreement between the model's predicted number of infections averted and the observed change in seroincidence (Bedimo, Pinkerton et al. 2002). The model estimates secondary infections, or infections of partners of HIV positive clients, as:

$$S(f) = \{1-\pi^*\}\, m\, [1- (1-x)^{(1-f)n}\, (1-x')^{fn}]$$

Where,

S = the number of secondary infections averted.
f = proportion of condom use.
π^* = the prevalence of HIV infection among sex partners
m = the number of sex partners.
x *and* x' = the per contact probability of transmission for unprotected and protected intercourse, respectively.
n = number of acts of intercourse per partner.

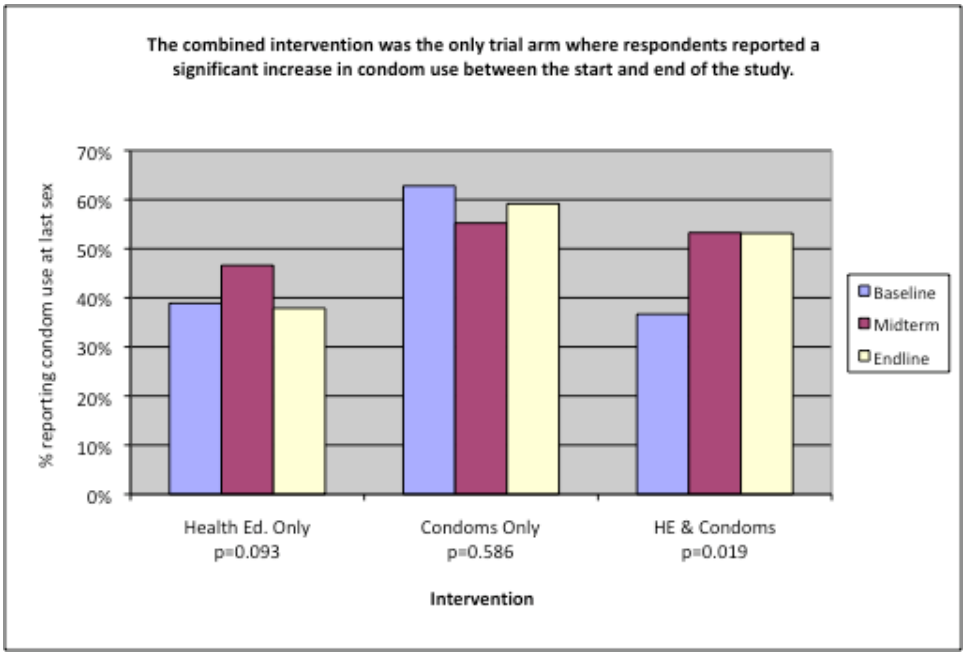
Therefore to calculate the number of infections averted by the intervention, the estimate based on the proportion of condom use at baseline was compared to the estimate based on the proportion of condom use at the end of the intervention among those exposed to the intervention. This number must be seen as a rough estimate, because the same people were not necessarily interviewed in both waves of interviews. The overall proportion of condom use among all respondents in each trial arm was compared to the proportion of condom use among those exposed to the various trial arms a year later. An estimate was generated for each arm of the trial. Infections averted among men and women were considered separately since the intervention may impact them differently and because

several parameters are different depending on gender. This calculation should make the policy implications of continuing the intervention after the trial easier to understand, and perhaps more convincing.

RESULTS

Descriptive Statistics

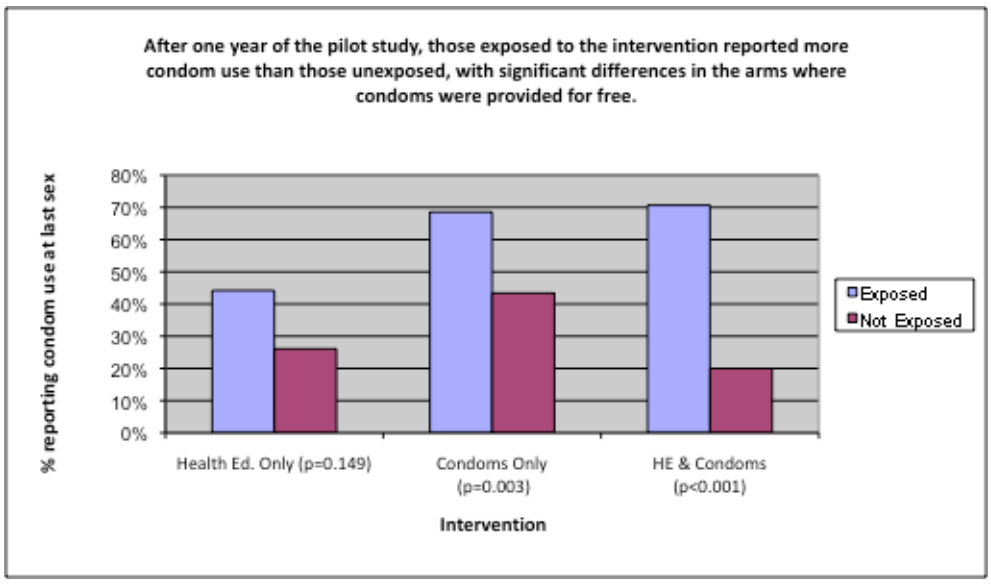
Figure 3 Reported Condoms use among Clients by type of Study Intervention



The demographic characteristics of the respondents at the second follow-up (referred to from here on as endline) are presented in **Table 2**. 225 clients were interviewed at baseline and 403 clients were interviewed at midterm. 570 were interviewed at endline. 29.65% were male. The mean age was 40.62 with ages ranging from 19 to 72. 87% of respondents were between 28 and 56 years old. 53.71% of respondents were married or cohabitating while another 37.1% were widowed and 9.19% were single. The mean number of living children was 2.31. 40.14% of respondents had received a Junior Secondary School or Middle School Leaving Certificate (JSS/MSLC), all other education levels were fairly evenly represented. 95.79% of respondents had visited the clinic before. 41.65% of respondents were visiting the clinic that day for an ARV follow up appointment and 63.8% were there to pick up medicine (respondents could report multiple reasons for visits). 58.83% of respondents were diagnosed over a year ago; a quarter had been diagnosed within the last six months. 78.84% of patients were currently taking ARVs.

Chi Square Tests

Figure 4: Condom use by Clients in Intervention Sites



Between the baseline and endline interviews, there was an increase in the number of people reporting that they used a condom at last sex across the three trial arms, however this increase was not significant in chi square testing. When each arm of the trial was examined, the health education and condom arm was the only one where the percent of respondents reporting condom use at last sex increased and it did so significantly in chi square testing (Pr=0.019), suggesting that the combined intervention may have

had the greatest effect on encouraging condom use. Between baseline and midterm, the same effect was observed; the combined arm was the only one that registered a significant change in condom use at last sex, and again, reported usage increased over the first six-month period. (**Tables 3 and 4**)

At endline, the 64.64% percent of respondents who reported being exposed to the intervention (receiving free condoms, receiving condom counseling, or receiving both, depending on the trial arm) were significantly more likely to report condom use at last sex than those unexposed in both the condom only (Pr=0.003) and health education and condom trial arms (Pr<0.001). (See **Table 5**).

Logistic Regression

1. The outcome variable has 44 responses of 'don't know' which were treated as missing data and the observations were removed from the analysis, leaving a sample size of 526. Therefore small sample size was a concern in cells with less than 10% of the total sample or 52 respondents. The following variables were initially treated as binary: gender, taking ARVs, trying to have a child, and disclosure status. Education was collapsed into a binary variable as well (primary education or more vs. less than primary education) in order to minimize the number of potential predictors. Small cell counts were noted for the 'trying to have a child' and 'on ARVs' variables, however since these were not primary predictors, the variables were left as candidates for the model. Due to small sample size, the marital status variable was dichotomized into 'married/ cohabitating' and 'not married/ cohabitating'. To avoid small cell counts, the exposure variable became binary between those exposed to free condoms (including both the condom only and the combined health education and condom interventions) and those not exposed to free condoms. This was justified by the fact that for both interventions involving free condoms, chi square testing indicated significant differences in condom use at last sex between those exposed and those unexposed, however the same did not hold true for the control arm – those exposed to condom counseling only. Diagnosis timing was also dichotomized into diagnosed more or less than a year ago due to small cell counts. Type of sexual partner was treated as a categorical variable and dummy coded, however, due to small cell counts, 'regular and occasional' and 'occasional' sexual partners were combined. Having (a) regular sex partner(s) was treated as the reference group for this variable since it was the largest subgroup for the variable. Time since sexual intercourse was dichotomized into 'reported sex in last 30 days' or 'did not report sex in last 30 days'. Finally, small cell counts were observed for 'partner's HIV status', but again the variables were included as candidates because they were not primary predictors. 'Partner's HIV status unknown' was the largest subgroup for this variable and hence was treated as the reference group. The continuous variables of age, number of living children, and number of sex partners in the last year were included and were examined in a later step to see if linear relationships with the outcome are reasonable. Frequencies for each subgroup are presented in **Table 6**. Because every cell contains some observations, non-convergence is not a concern.

2. Results from univariate regression are presented in **Table 7**. Based on the inclusion rule above, all variables are candidates for multivariate analysis except for 'occasional sex partner' and 'partner HIV negative' however they are included since other subgroups within these variables were significant. The variables are: male, trying to have a child, taking ARVs, HIV status disclosed, completed primary education, married, exposed to free condoms, diagnosed less than a year ago, regular sex partners, occasional sex partners, no sex partner, had sex in last 30 days, partner is HIV positive, partner is HIV negative, partner's HIV status unknown, age, number of living children, and number of sex partners.

3. The results of the preliminary forward selection automated procedure yielded the following variables at the 0.05 level of significance: exposed to free condoms, had sex in the last 30 days, no sex partner, taking ARVs, number of sex partners, diagnosed less than a year ago, and having an HIV positive partner.

4. When each candidate variable was tested for its confounding effect, HIV status disclosed, being married, trying to have a child, age, number of living children, and having an HIV negative partner were found to affect the beta coefficients by more than ten percent so are included in the model.

5. Exposure to free condoms was already included in the model according to the automated procedure. Having occasional or regular and occasional partner(s) is returned to the model since another subgroup within the same variable (no sexual partner) is included.

6. Because there are 15 variables, overfitting is not a problem in the initial model.

7. The three variables treated as continuous that remained in the model were checked to determine if their impact on the outcome variable was linear. All three – age, number of living children, and number of partners – were divided into equal width bins and inserted into the model in dummy coded format. Since none of the resulting betas yielded equal step sizes, the linearity assumption was not met and the variables are included as dummy coded categorical variables. Age 19-33 was treated as the reference group since it was the largest subgroup within the age variable. Number of living children was divided into three variables; one child, two children, or two or more, since this split yielded fairly equal subgroups. Have two or more was treated as the reference group. Number of partners was divided into three variables as well; no sex partners, one partner, or two or more – having one partner was considered the reference group. I checked for confounders again by rerunning the model with these categorical variables included –gender, disclosure status, being married, having a positive partner, having more than a primary education, trying to have a child, and having a negative partner were found to be confounders. If one subgroup of a variable was included in the model, all other subgroups (except the reference group) were returned to the model. The final model had 21 variables, therefore overfitting was not a problem. Odds ratios and p values are presented in **Table 8**.

8. The Hosmer-Lemenshow Goodness of Fit test yielded a p value of 0.5619 and a X^2 value of 271.70, indicating that the model did not compare well with the observed data.

The logistic regression model is the following:

Logit p = -2.06 + 1.38(EXPOSED) + 0.59(MALE) + 0.09(CHILD) + 1.81(ARV) + 0.72(DISCLOSED) + 0.37(PRIMARY) – 1.29(MARRIED) – 1.13(DIAGTIME) + 0.23 (OCC) – 3.50(NOPARTNER) + 2.07(SEXTIME) + 0.42(PARTNERPOS) + 0.21(PARTNERNEG) + 0.60(AGE2) + 1.44(AGE3) + 0.81(AGE4) + 1.47(NOCHILDREN) + 0.41(ONECHILD) – 2.63(PARTNERZERO) + 0.61(PARTNERTWO)

Based on this model, being exposed to either free condom intervention is associated with a 297% increase in the odds of using a condom at last sex compared to people who were not exposed, suggesting that the intervention significantly increases the log odds of using a condom at last sex. Currently taking ARVs is also associated with a significant increase in the log odds of condom use (OR=6.09). Being married has a negative effect on the log odds of condom use (OR=0.27); being diagnosed within the last year produces a similar significant negative effect (OR=0.32) compared to those who have known their status for longer. Those who reported no current sexual partner were 97% less likely to report using a condom at last sex. Similarly, those who reported having sex in the last 30 days were 695% more likely to report using a condom at last sex than those who did not have sex in the last month. Being age 40 to 46 was associated with a 321% increase in the log odds of using a condom at last sex compared to being age 19 to 33. Having no living children was associated with a significant increase in the log odds of condom use (OR=4.36) compared to those with two or more children. Reporting zero sex partners in the last year was associated with a 93% decrease in the log odds of condom use at last sex compared to those who reported one partner. Please see **Table 8** for presentation of the other non-significant odds ratios.

Estimate of Infections Averted

As mentioned above, secondary infections averted can be estimated with the following model:

$$S(f) = \{1-\pi^*\}\ m\ [1- (1-x)^{(1-f)n}\ (1-x')^{fn}]$$

Based on the data yielded by the surveys, presented in **Table 9**, each woman reached by free condoms would have passed along 0.0059 infections to her partners given her condom use before the intervention. After being exposed to the condom only or combined condom and health education intervention, each woman would pass along 0.0042, suggesting that the intervention does slightly prevent infections among partners of women. When the difference in the secondary infection rate is multiplied by the number of women reached by the intervention, the total number of infections averted is 22.47 over the 12 months of the study. Each man reached by free condoms would have passed along 0.0049 infections to his partners given his condom use before the intervention. After being exposed to either intervention distributing free condoms, each man would pass along 0.0034 infections, suggesting that the intervention again prevented infections among partners of men. The total number of infections averted for partners of men was 9.27 over the 12 months of the study. In the arm of the trial where health education and condom distribution were combined, 12.53 infections were averted among partners of women and 7.79 infections were averted among partners of men. In the condom only arm, 3.49 infections were averted among partners of women, and condom use actually fell between the start and end of the study for men, so no infections were averted. In the Health Education only arm, 0.29 infections were averted among men; no infections were averted among women again because of a decrease in self-reported condom use. Limitations for the parameters are outlined in the discussion.

DISCUSSION

Outcomes

The frequency tables and chi square test comparing baseline and endline show that the combined health education and condom intervention was the only one where respondents reported a significant increase in condom use at last sex between the end of the pilot study and the beginning. However, a more meaningful measure was the one that looked at condom use among those respondents who were actually exposed to the intervention. In that chi square test, being exposed to either arm where condoms were provided for free was associated with a significant increase in the likelihood of reporting condom use at last sex. To examine this association more carefully, the logistic regression was conducted, and the significant odds ratio for exposure to free condoms (3.97) was consistent with the chi square test findings that those who received free condoms over the past six months were more likely to use a condom at last sex than those who did not receive free condoms.

The fact that the difference in condom use at last sex between the exposed and the unexposed at the same facilities was the largest in the trial arm where condom counseling was provided along with free condoms suggests that the combined intervention may be more effective than the condom only intervention. However, the percentage of unexposed respondents reporting condom use at last sex was much higher at Korle-Bu (43.40%), the facility that provided condoms alone, than at the three facilities offering the combined intervention (20%). This suggests that there may have been differences in the characteristics of the two study populations that affect condom use at last sex. Looking at all the variables found significant in the logistic regression showed that the two populations were not the same for each predictor. For example, 84.29% of respondents at Korle-Bu reported taking ARVs (which is associated with increased condom use at last sex) while 73.5% did so at the combined intervention facilities. 54.23% of respondents at Korle-Bu were married or cohabitating (associated with decreased condom use), versus 56.69% at the combined intervention facilities. However it was not the case that the Korle-Bu population was predisposed to higher condom use for all predictors; some characteristics of the combined facilities' population were associated with a higher rate of condom use. For example, 37.78% of respondents at the combined facilities reported having sex in the last 30 days (associated with increased condom use at last sex) while 31.21% of respondents from Korle-Bu reported the same. Therefore, the differences in the study populations make it difficult to determine whether the combined intervention was truly more effective than the condom only arm.

Limitations

While the Bernoulli process model is a useful way to translate the impact of the intervention into a politically powerful unit of measurement, several limitations in its calculation must be kept in mind. The first is related to HIV prevalence in study partners. While the endline survey asked respondents if any of their partners were HIV positive, 35.62% reported that they did not know. Therefore, HIV prevalence was calculated based on the percent of respondents who said that their partner was positive. It is likely that the prevalence figure is higher, since some percentage of the unknown partners is probably HIV positive. And even respondents who reported that their partner was not positive may not have known for sure, since it takes months after infection for an HIV test to show that someone is positive. Therefore the estimate of infections averted is probably an over-report, since there are already more sero-concordant partnerships among the study population than the numbers suggest. It is also hard to assess the accuracy of the data source for clients reached by the intervention. While the number reflects everyone who received condoms during the six-month period according to clinic staff, it does not account for the number of times people received condoms, and it is unclear how often someone would need to be exposed to the intervention for it to have an effect on behavior change. In addition, the number of condoms supplied to the facilities was sometimes exceeded by the number of condoms the facilities reported distributing. This suggests some error in recording at the facility level, or that there was another source of free condoms. For example, Ridge Hospital reported receiving a donation of condoms during the course of the study.

There were several other limitations to the study. One was that those interviewed at baseline were not necessarily the same people interviewed at endline. Therefore, while condom use may have risen in the population, it is not possible to track changes at an individual level, which would provide a more accurate picture of who was most or least affected by the intervention, and may lead to different outcomes in the chi square tests. The endline survey did ask whether clients had been interviewed before, which gives us a window into the overlap between survey waves. 26.81% of respondents reported being interviewed previously for the condom study. Therefore any analyses comparing waves should be treated with caution, as approximately three fourths of respondents at the endline were not polled in either the baseline or midterm surveys.

The survey also could not determine if respondents were members of any of the high-risk populations that are fueling the epidemic in Ghana, which would be an important factor to understand. For example, if respondents were current sex workers, their behavior change may have greater significance in terms of the epidemic, given their higher number of sexual partners. Responses to the question about number of sexual partners in the past year were not high enough to indicate that sex workers were participating in the intervention, but stigma may have prevented some respondents from answering this question truthfully. In the absence of information about individual respondents, it would also be useful to have some background information on the profiles of the individuals visiting the various facilities. The fact that condom use was higher at Korle-Bu at baseline, (62.79% versus 37.88% elsewhere) suggests there may be something unusual about the patients visiting those facilities. In fact, KorleBu was selling condoms at the HIV unit prior to the launch of the study, and clients there were sensitized to condom use and empowered to purchase them. Because of this sensitization, clients may have been more prone to report condom use because it was the 'right' answer than clients at other facilities. Because the condom only intervention only took place at Korle-Bu, it is also hard to distinguish between the impact of the intervention and the impact of the facility itself.

Benefits

There are benefits to the condom distribution and health education intervention. By combining HIV prevention directly with treatment, the positive outcome of the study makes a contribution to the argument that integrating both sides of the fight against AIDS is the most effective way to reverse increasing incidence rates. The intervention under study – free condoms and education for HIV positive individuals – responds appropriately to the epidemiology of the disease in Ghana by providing a targeted intervention to a high prevalence group in a low prevalence epidemic. It is also a potential vehicle to promote the female condom, the widespread use of which has suffered from a lack of support by health authorities in Ghana. Finally this project seems to be one of few interventions in Africa responding in some way to the sexual and reproductive health needs of people living with HIV. It addresses the relatively new reality that ART clients are capable of and willing to have an active sex life for a period of years despite their HIV diagnosis. There is certainly more to be done to make reproductive health services safe and accessible, but providing condoms to PLWHIV has the potential to contribute to preventing HIV transmission in Accra.

Conclusion

The analysis found that self-reported condom use among HIV positive clients (as measured by condom use at last sex) was higher among those who were exposed to free condom distribution over a one year period than among those who were not exposed to free condoms over the same period. (OR=3.97, p=0.001) Exposure to condom counseling without free condom distribution did not result in a significant increase in the number of clients reporting condom use at last sex. In the arm of the trial where health education and condom distribution were combined, approximately 12.53 infections were averted among partners of women and approximately 7.79 infections were averted among partners of men over the one year period. In the condom only intervention, 3.49 infections were averted among partners of women. Because reported condom use at last sex fell between the start and end of the study for men at the condom only facility, no infections were averted among their partners. In the

Health Education only arm, 0.29 infections were averted among men; no infections were averted among women again because of a decrease in self-reported condom use.

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TABLES

Table 1: Sample size per facility

	Baseline			Midterm		
Name of Facility	Number Receiving Clinical Care	Required Sample	Actual Sample	Number Receiving Clinical Care	Required Sample	Actual Sample
Intervention Facility (Free condoms only)						
Korle-bu Teaching Hosp.	6259	91	90	7670	113	99
Intervention Facilities (Free condoms and Health Education) – oversampled 20%						
Police Hospital	83	1	5	214	3	8
Ridge Hospital	168	3	15	924	14	70
Koforidua Regional Hosp.	519	8	42	1445	21	120
Subtotal (Intervention)	**7029**	**103**	**152**	**10253**	**150**	**297**
Non-Intervention (Health Education only)						
Tema General Hospital	426	15	15	829	29	30
Atua Government Hosp.	1623	57	58	2160	76	76
Subtotal (Control)	**2049**	**72**	**73**	**2989**	**105**	**106**
Totals	**9078**	**175**	**225**	**13,242**	**255**	**403**

Table 2: End line Survey Participant Demographics *(percentages sum vertically)*

	Health Ed	Condoms	Health Ed & Condoms	Overall
ENDLINE				
Overall	74	158	338	570
Gender				
Male	27 (36.49%)	40 (25.32%)	102 (30.18%)	169 (29.65%)
Female	47 (63.51%)	118 (74.68%)	236 (69.82%)	401 (70.35%)
Total	74	158	338	570
Age				
18 to 27	6 (8.22%)	6 (3.80%)	29 (8.58%)	41 (7.21%)
28 to 37	17 (23.29%)	55 (34.81%)	118 (34.91%)	190 (33.39%)
38 and up	50 (68.49%)	97 (61.39%)	191 (56.51%)	338 (59.40%)
Total	73	158	338	569
Marital Status				
Single	5 (6.76%)	23 (14.56%)	24 (7.19%)	52 (9.19%)
Married	29 (39.19%)	61 (38.61%)	131 (39.22%)	221 (39.05%)
Divorced	11 (14.86%)	13 (8.23%)	54 (16.17 %)	78 (13.78%)
Separated	5 (6.76%)	6 (3.80%)	20 (5.99%)	31 (5.48%)
Widowed	14 (18.92%)	35 (22.15)	52 (15.57%)	101 (17.84%)
Partnered	10 (13.51%)	20 (12.66%)	53 (15.87%)	83 (14.66%)
Total	74	158	334	566
Number of living children				
0	7 (9.46%)	21 (13.29%)	66 (19.64%)	94 (16.55%)
1	20 (27.03%)	39 (24.68%)	65 (19.35%)	124 (21.83%)
2	14 (18.92%)	35 (22.15%)	70 (20.83%)	119 (20.95%)
3	13 (17.57%)	25 (15.82%)	62 (18.45%)	100 (17.61%)

	Health Ed	Condoms	Health Ed & Condoms	Overall
4+	20 (27.03%)	38 (24.05%)	73 (21.73%)	131 (23.06%)
Total	74	158	336	568
Education				
None	9 (12.16%)	24 (15.19%)	49 (14.58%)	82 (14.44%)
Some primary	7 (9.46%)	26 (16.46%)	47 (13.99%)	80 (14.08%)
Primary	10 (13.51%)	14 (8.86%)	27 (8.04%)	51 (8.98%)
Some JSS	6 (8.11%)	9 (5.70%)	37 (11.01%)	52 (9.15%)
JSS/MSLC	34 (45.95%)	60 (37.97%)	134 (39.88%)	228 (40.14%)
SSS or more	8 (10.81%)	25 (15.82%)	42 (12.50%)	75 (13.20%)
Total	74	158	336	568
Visit number				
First visit	3 (4.05%)	3 (1.90%)	18 (5.33%)	24 (4.21%)
> First visit	71 (95.95%)	155 (98.10%)	320 (94.67%)	546 (95.79%)
Total	74	158	338	570
Diagnosis timing				
0 to 6 months	21 (28.38%)	17 (10.97%)	105 (31.16%)	143 (25.27%)
7 to 12 months	15 (20.27%)	15 (9.68%)	60 (17.80%)	90 (15.90%)
12 + months	38 (51.35%)	123 (79.35%)	172 (51.04%)	333 (58.83%)
Total	74	155	337	566
ARV Status of Patient				
Now taking	64 (86.49%)	132 (84.62%)	251 (74.48%)	447 (78.84%)
About to start	0 (0%)	3 (1.92%)	32 (9.50%)	35 (6.17%)
Not taking	9 (12.16%)	21 (13.46%)	54 16.02%)	84 (14.81%)
Not sure	1 (1.35%)	0 (0%)	0 (0%)	1 (0.18%)
Total	74	156	337	567

Table 3: Change in Condom Use between Baseline and Final

Condom Use at Last Sex	Baseline	Final	Total
OVERALL	47.7% (104/218)	52.85% (278/526)	51.34%(382/744)
Yes	104	278	382
No	114	248	362
Total	218	526	744
Pearson chi2(1) = 1.6333 Pr = 0.201			
HEALTH ED. ONLY	38.89% (28/72)	37.88% (25/66)	(53/ 138) 38.41%
Yes	28	25	53
No	44	41	85
Total	72	66	138
Pearson chi2(1) = 0.0149 Pr = 0.903			
CONDOMS ONLY	62.79% (54/86)	59.15% (84/142)	60.51% (138/228)
Yes	54	84	138
No	32	58	90
Total	86	142	228
Pearson chi2(1) = 0.2963 Pr = 0.586			

Condom Use at Last Sex	Baseline	Final	Total
HE & CONDOMS	36.67% (22/60)	53.14% (169/318)	50.53% (191/378)
Yes	22	169	191
No	38	149	187
Total	60	318	378
Pearson chi2(1) = 5.4828 Pr = 0.019			

Table 4: Change in Condom Use between Baseline and Midterm

Condom Use at Last Sex	Baseline	Midterm	Total
OVERALL	47.7% (104/218)	51.96% (199/383)	50.42% (303/601)
Yes	104	199	303
No	114	184	298
Total	218	383	601
Pearson chi 2 (1) = 1.005 p = 0.316			
HEALTH ED. ONLY	38.89% (28/72)	46.61% (48/103)	43.43% (76/175)
Yes	28	48	76
No	44	55	99
Total	72	103	175
Pearson chi2 (1) = 1.026 p = 0.311			
CONDOMS ONLY	62.79% (54/86)	55.21% (53/96)	58.79% (107/182)
Yes	54	53	107
No	32	43	75
Total	86	96	182
Pearson chi2 (1) = 1.077 p = 0.299			
HE & CONDOMS	36.67% (22/60)	53.26% (98/184)	49.18% (120/244)
Yes	22	98	120
No	38	86	124
Total	60	184	244
Pearson chi2 (1) = 4.985 p=0.026			

Table 5: Condom use by exposure to three trial arms

Condom Use at Last Sex	Exposed to intervention	Not exposed to intervention	Total
HEALTH ED. ONLY	44.19% (19/43)	26.09% (6/23)	37.88% (25/66)
Yes	19	6	25
No	24	17	41
Total	43	23	66
Pearson chi2(1) = 2.0861 Pr = 0.149			
CONDOMS ONLY	68.54% (61/89)	43.40% (23/53)	59.15% (84/142)
Yes	61	23	84
No	28	30	58
Total	89	53	142
Pearson chi2(1) = 8.6913 Pr = 0.003			
HE & CONDOMS	70.67% (147/208)	20.00% (22/110)	53.14% (169/318)
Yes	147	22	169
No	61	88	149
Total	208	110	318

Condom Use at Last Sex	Exposed to intervention	Not exposed to intervention	Total
Pearson chi2(1) = 74.1933 Pr < 0.001			

Table 6 Frequencies of binary, ordinal, and continuous variables in the endline data

Variable	Reported condom use at last sex	Did not report condom use at last sex
Overall	**278**	**248**
Male	105	54
Female	173	194
Trying to have a child	40	18
Not trying to have a child	229	223
On ARVs	241	169
Not on ARVs	36	77
HIV status disclosed to partner	195	64
HIV status not disclosed to partner	56	59
More than primary education	188	139
Primary education or less	90	107
Married / co-habitating	197	95
Not married / not co-habitating	79	151
Exposed to free condoms	208	89
Not exposed to free condoms	70	159
Diagnosed less than a year ago	98	120
Diagnosed more than a year ago	178	126
Regular sexual partners	209	73
Occasional sexual partners	40	32
No sexual partner	29	142
Last sex within 30 days	158	22
Last sex longer ago than 30 days	116	225
Partner has HIV	101	25
Partner does not have HIV	82	45
Partner's HIV status unknown	71	69
Age	Mean = 39.22	Mean = 41.26
Number of living children	Mean = 2.13	Mean = 2.38
Number of sex partners	Mean=2.15	Mean = 2.89

Table 7: **Point estimates, odds ratios, confidence intervals and p values for univariate regressions of intervention exposure type, and other important variables with condom use at last sex.** *(shaded rows reflect significant variables less than p=0.05)*

Variable	Point Estimate (B)	Standard Error	Point Estimate (OR)	95% Confidence Limits (OR)	P-value
Male	0.78	0.20	2.18	(1.48, 3.21)	<0.0001
Trying to have a child	0.78	0.30	2.16	(1.20, 3.89)	0.010
Taking ARVs	1.12	0.23	3.05	(1.96, 4.75)	<0.0001
HIV Status disclosed	1.17	0.24	3.21	(2.02, 5.09)	<0.0001
Completed primary education	0.47	0.18	1.61	(1.13, 2.30)	0.009
Married	1.38	0.19	3.96	(2.75, 5.72)	<0.0001
Exposed to free condoms	1.67	0.19	5.31	(3.65, 7.72)	<0.0001
Diagnosed less than a year ago	-0.55	0.18	0.58	(0.41, 0.82)	0.002
Has regular sex partner(s)	1.97	0.20	7.21	(4.91, 10.62)	<0.0001
Has occasional sex partner(s)	0.12	0.25	1.12	(0.68, 1.86)	0.634
No sexual partner	-2.45	0.23	0.08	(0.05, 0.14)	<0.0001
Had sex in last 30 days	2.63	0.25	13.93	(8.46, 22.94)	<0.0001
Partner is HIV positive	1.10	0.26	3.01	(1.82, 4.97)	<0.0001
Partner is HIV negative	-0.00	0.22	1.0	(0.64, 1.55)	0.985
Partner's HIV status unknown	-0.93	0.22	0.39	(0.26, 0.61)	<0.0001
Age 19-33	0.13	0.19	1.13	(0.77, 1.67)	0.520
Age 34-39	0.27	0.21	1.30	(0.87, 1.95)	0.199
Age 40-46	0.20	0.21	1.22	(0.82, 1.82)	0.332
Age 47-72	-0.59	0.21	0.55	(0.37, 0.83)	0.004
Has zero living children	0.47	0.24	1.60	(1.01, 2.55)	0.047
Has one living child	-0.27	0.21	0.76	(051, 1.15)	0.198
Has more than one living child	-0.08	0.18	0.92	(0.65, 1.31)	0.662
Reported zero partners last year	-2.89	0.28	0.06	(0.03, 0.10)	<0.0001
Reported one partner last year	1.94	0.20	6.99	(4.69, 10.41)	<0.0001
Reported more than one partner last year	0.76	0.32	2.13	(1.13, 4.02)	0.019

TABLE 8 Odds ratios, P-values and 95% confidence intervals for multivariate relations of intervention exposure type and other important variables with condom use at last sex in the midterm data. N=526

Variable	Point Estimate (B)	Standard Error	Point Estimate (OR)	95% Confidence Limits (OR)	P-value
Exposed to free condoms (EXPOSED)	1.38	0.41	3.97	(1.79, 8.80)	0.001
Male (MALE)	0.59	0.46	1.78	(0.73, 4.46)	0.205
Trying to have a child (CHILD)	0.09	0.56	1.09	(0.37, 3.24)	0.876
Taking ARVs (ARV)	1.81	0.44	6.09	(2.56, 14.52)	<0.0001
HIV Status disclosed (DISCLOSED)	0.72	0.59	2.06	(0.65, 6.54)	0.218
Completed primary education (PRIMARY)	0.37	0.43	1.44	(0.62, 3.34)	0.394
Married (MARRIED)	-1.29	0.63	0.27	(0.08, 0.93)	0.038
Diagnosed less than a year ago (DIAGTIME)	-1.13	0.42	0.32	(0.14, 0.74)	0.007
Has occasional sex partner(s) (OCC)	0.23	0.63	1.25	(0.36, 4.34)	0.721
No sexual partner (NOPARTNER)	-3.50	1.10	0.03	(0.00, 0.26)	0.001
Had sex in last 30 days (SEXTIME)	2.07	0.45	7.95	(3.32, 19.03)	<0.0001
Partner is HIV positive (PARTNERPOS)	0.42	0.59	1.52	(0.48, 4.83)	0.479
Partner is HIV negative (PARTNERNEG)	0.21	0.55	1.23	(0.42, 3.62)	0.704
Age 34-39 (AGE2)	0.60	0.52	1.81	(0.66, 5.02)	0.251
Age 40-46 (AGE3)	1.44	0.65	4.21	(1.18, 15.01)	0.027
Age 47-72 (AGE4)	0.81	0.62	2.24	(0.67, 7.56)	0.192
Has zero living children (NOCHILDREN)	1.47	0.62	4.36	(1.29, 14.72)	0.018
Has one living child (ONECHILD)	0.41	0.49	1.51	(0.58, 3.93)	0.394
Reported zero partners last year (PARTNERZERO)	-2.63	0.75	0.07	(0.01, 0.32)	<0.0001
Reported more than one partner last year (PARTNERTWO)	0.61	0.64	1.84	(0.52, 6.53)	0.343
Constant	-2.06	0.94	-	-	-

*Word in parentheses is the variable name included in the regression model presented in the text. Shaded rows reflect significant variables less than p=0.05

Table 9: Parameters used for estimating infections averted (examined for a one year period)

Parameter	Either arm with free condoms		Combined Health Ed. & Condoms		Condoms only		Health Education Only		Source
	Female	Male	Female	Male	Female	Male	Female	Male	
Clients reached by intervention (N)	13295	6305	4343	1887	8952	4418	1078	498	Number of clients who received condoms or counseling, depending on the trial arm, according to study service statistics.*
Acts of intercourse, per client	13.08	21.60	14.04	21.12	11.40	23.04	11.64	11.04	Mean number of self-reported sexual acts in the last month for those exposed to the interventions multiplied by 12
Sex partners (m)	0.80	1.15	0.80	1.22	0.81	0.96	0.60	1.31	Mean number of self-reported sex partners in the past 12 months at endline for those exposed to the interventions
Acts of intercourse, per partner (n)	16.35	18.78	17.55	17.31	14.07	24	19.4	8.43	Acts of intercourse per client divided by number of sex partners according to pilot study
Proportion of condom use at baseline (f1)	0.45	0.68	0.32	0.50	0.54	0.79	0.68	0.28	Percent of respondents reporting condom use at last sex at baseline.
Proportion of condom use at endline (f2)	0.64	0.81	0.64	0.83	0.65	0.78	0.62	0.37	Percent of respondents exposed to interventions reporting condom use at last sex at endline.
Prevalence of HIV in study population (π)	1	1	1	1	1	1	1	1	Assumed that all ART clients are HIV positive
Prevalence of HIV infection in study partners (π^*)	0.2385	0.4149	0.2800	0.3380	0.6522	0.4583	0.4167	0.3500	Based on percent of respondents' reporting that any of their partners is HIV positive among respondents exposed to the intervention
Probability of HIV transmission, per act of unprotected intercourse (x)	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	(Bedimo, Pinkerton et al. 2002)
Probability of HIV transmission per act of condom-protected intercourse (x')	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	(Bedimo, Pinkerton et al. 2002)
Number of secondary infections given condom use at baseline	0.0059	0.0049	0.0072	0.0077	0.0020	0.0036	0.0026	0.0054	(Bedimo, Pinkerton et al. 2002)
Number of secondary infections given condom use at endline	0.0042	0.0034	0.0043	0.0035	0.0016	0.0037	0.0030	0.0048	(Bedimo, Pinkerton et al. 2002)

Parameter	Either arm with free condoms		Combined Health Ed. & Condoms		Condoms only		Health Education Only		Source
	Female	Male	Female	Male	Female	Male	Female	Male	
Number of secondary infections averted among study partners	22.47	9.27	12.53	7.79	3.49	-0.49	-0.39	0.29	(Bedimo, Pinkerton et al. 2002)

*Note that a client was considered reached by the intervention in the combined arm if he or she received free condoms. The facilities where the combined intervention took place reported high numbers of clients receiving condoms and low numbers of clients receiving counseling. For example, Koforidua Regional Hospital reported that 660 female clients received education on condom use but 3326 female clients received condoms. Therefore, the number of clients reached was defined as the number of clients receiving free condoms.